DOCUMENT RESUME

ED 166 179 SP 013 818

AUTHOR	Corbin, Charles B., Ed.
TITLE	Sport, Health, Fitness and Dance. AAHPER Research Consortium Symposium Papers.
INSTITUTION	American Alliance for Health, Physical Education, and Recreation, Washington, D.C.
PUB DATE	78
NOTE	101p.; Parts marginally legible due to small type
AVAILABLE FROM	AAHPER Publications-Sales, 1201 16th St., N.W., Washington, D.C. (Stock #248-26234, $3.00)
EDRS PRICE	MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS	*Athletics; Cardiovascular System; Dance; *Exercise (Physiology); Human Body; Injuries; Physical Activities; *Physical Fitness; *Physical Health; *Physiology; Research; Running; Swimming; Womens Athletics

ABSTRACT

This collection of symposium papers provides current synthesis of research in the field of physical education and health. In this volume the physiological aspects of physical activities are discussed. The effects of chronic heavy physical training in swimming are examined, comparing age groups and males and females. Stress factors are also considered in the performance of jogging and running. Ways of preventing injuries in dance are suggested, as well as relaxation techniques effective in all physical activities. (JI)

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AAHPER Research Consortium

SYMPOSIUM PAPERS:

SPORT, HEALTH, FITNESS AND DANCE

ED166179

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VOLUME I BOOK 2

1978

SP 013 818

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A NOTE TO THE READER

The Symposium Papers (Volume I, Books 1, 2, and 3) are published with one major purpose in mind. The papers are intended to provide the reader with an up-to-date synthesis of research in a wide variety of areas. Presentations were invited from each of the seven associations of AAHPER. Review boards screened Symposium Presentations under the direction of the Research Consortium President-elect. Special attention was given to the quality of the presentations and to the relevance of the research syntheses to the practioners in each of the seven associations.

The Symposium Papers are being made available for sale, for the first time, at the convention at which the actual papers are presented. This is done to make these research syntheses available to Alliance members at the earliest possible time, while the information is current and useful. To do this, it was necessary to make each author responsible for preparing his or her own manuscript. To be eligible for publication authors were required to submit their intent to publish early in the year and submit a manuscript, typed in the proper format, by March 1, 1978. In cases where authors failed to meet the above listed guidelines, the papers were deleted from this publication.

These Symposium Papers are photographed from original manuscripts submitted by each author. The screening of symposia served as the editing process, once accepted sole responsibility for the content rests with the author(s).

Because the Symposium Papers presented at the 1977 convention were not published, authors of these papers were invited to submit them for publication in this 1978 volume. Accordingly, Volume I includes some papers from 1977 as well as those from 1978.

It is hoped that these Symposium Papers are useful to members of all associations of AAHPER.

Charles B. Corbin
Editor

Christine L. Wells
President-elect
Research Consortium

Note: Because of the length limitation imposed on authors, reference lists are necessarily short. In most cases, more complete reference lists are available from authors on request.

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The Effects of Chronic Heavy Physical Training On Age Group Swimmers From 10-17 Years of Age: A Symposium

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In the years since 1953, when the modern age group swimming program began, the sport of competitive swimming has greatly changed. Records for each event in the program have improved steadily, year by year. This trend continues today. Internationally prominent female swimmers routinely do better than the world record performances of the best male athletes of twenty-five years ago.

Over this same period of time, and apparently contributing to this trend, training programs have also changed. Some of the changes which have taken place can be listed as follows:

1. The use of interval training in the preparation of swimmers.
2. A great increase in total training distances per average training day.
3. An increase in the average number of workouts per week across a training year.

The above trend can be illustrated by saying that the most accomplished world class swimmers of twenty-five years ago rarely swam more than 7,000 yards per day. Today, by the time he is twelve or thirteen years of age, a youngster in a well-developed age group swimming program who has been training for a couple of years is likely to be swimming as much as 15,000 meters or more per day. In addition, swimming has become a year-round sport with only a few weeks per year away from the pool. The results of these circumstances is to subject young children to workloads greater than any previously known.

Parents, teachers, and coaches have long wondered what the effects of this great physical stress might be; whether beneficial or detrimental. It is in hope that we may shed some light on this problem that this symposium and the research papers included are presented.

The studies herein presented were supported in part by a grant from the Central Ohio Heart Association.

Effects of Chronic Heavy Physical Training on Female Age-Group Swimmers

Pamela S. Robinson, Garret P. Caffrey, Rhonda R. Ridinger
C. William Steinmentz, Robert L. Bartels and Thomas E. Staffer

INTRODUCTION

Currently in the United States there are 1½ to 2 million swimmers in some phase of active training for competitive swimming. This large number, which has increased greatly over the last 20 years, has been due to growth of the age-group (17 years of age and younger) swimming program.

Much of the progress in swimming records has been attributed to the greatly increased difficulty of the training programs undertaken by competitive swimmers. Some of the recent changes which have developed to prepare swimmers for competition are: (1) the use of interval training programs, (2) a large increase in the total training distance per average training day, and (3) an increase in the average number of workouts per week during a training year. Because of the success of some outstanding swimmers engaged in such programs, it has been assumed that such heavy work is always beneficial. The lack of information regarding the physical effects of strenuous training programs on children indicates considerable need for further studies in this area.

The purpose of this study was to determine the effects of chronic heavy physical training upon selected physiological variables in female age-group swimmers from 10 to 16 years of age.

METHODS AND PROCEDURES

The 12 experimental subjects were female age-group swimmers (10-16 years of age) involved in the successful age-group swimming program of Upper Arlington, Ohio. Twelve girls (10-16 years of age) from the public school physical education programs in the same general area constituted the control group. The experimental and the control subjects were matched according to chronological age, ponderal index, and body surface area. Physiological age was determined by hand-wrist X-rays. Maturational age was determined by the method of Tanner (1955).

A health appraisal, which consisted of examination of the cardiovascular, pulmonary, and musculoskeletal systems, was administered to determine if the subjects were physically able to participate in a strenuous testing program. After acceptance by the monitoring pediatrician of the study, the subjects were familiarized with the bicycle ergometer and the respiratory apparatus and the testing procedures were explained. A submaximal bicycle ergometer ride was performed by each subject. An extrapolated minute heart rate was used as an evaluative criterion to determine the initial work load which would be performed at the onset of the maximal bicycle ergometer test.

During the pre-training testing session, the subjects performed a maximal bicycle ergometer test to determine the capacities of their anaerobic (alactacid and lactacid) and aerobic energy systems. The bicycle ergometer test utilized a discontinuous loading method and was performed on a Jacquet Universal ergometer at a constant rate of 60 rpm. The work load was ad-

justed for each subject so that she would reach exhaustion after approximately 3 rides of 4 minutes each. The rides were separated by a 10 minute rest period.

The open circuit method was used to determine oxygen consumption. Inspired air volumes were recorded by two Parkinson Cowan CD-4 gas meters arranged in sequence so that continuous readings were possible. Minute determinations of the expired air were drawn from a mixing chamber and collected in 3 liter rubber sample bags. The expired samples were transferred directly into a Beckman LB-1 carbon dioxide analyzer and a Beckman E-2 oxygen analyzer. The oxygen consumption was calculated according to the standard method presented by Mathews and Fox (1971).

Forearm venous blood samples were taken prior to exercise and 5 minutes following the completion of the maximal test. Blood lactic acid concentrations were determined using the colorimetric method of Barker and Summerson (1941). Resting, exercise, and recovery heart rates were also recorded using a Hewlett-Packard ECG Model 1500 A.

During the interim between the maximal oxygen uptake tests, the experimental subjects participated in their usual interval training workouts under the direction of their coach. The subjects swam as much as 12,000-14,000 meters per day in as many as 3 workouts, training up to 6 days per week. The control subjects engaged in their regular daily activities, but they were not allowed to train in an age-group swimming or track program.

The post-training maximal bicycle ergometer test was administered again to both groups in the spring, immediately following the completion of the swimmers' competitive season. Blood lactic acid concentrations and resting, exercise, and recovery heart rates were also determined.

RESULTS AND DISCUSSION

The bicycle ergometer was chosen for the maximal oxygen consumption test because it is a neutral activity requiring a minimum of skill which most children have acquired. The bicycle ergometer also meets the standards suggested by Astrand and Rodahl (1970) for an optimal measurement of exercise fitness.

Investigations of the maximal oxygen uptake during adolescence are relatively few. Allen et al. (1956) studied young girls whose mean max $\dot{V}O_2$ was 38.3 ml/kg-min. Kramer and Lurie (1964) reported a max $\dot{V}O_2$ of 49.5 ml/kg-min. for girl swimmers and 27.5 ml/kg-min. for untrained girls. Cunningham and Eynon (1973) reported mean values of 46.2 ml/kg-min. for girl swimmers 12.2 years old, 43.4 ml/kg-min. for 13.2 year old girl swimmers, and a value of 40.5 ml/kg-min. for girl swimmers 14.9 years of age. Holmer (1972) has reported a mean max $\dot{V}O_2$ of 58.3 ml/kg-min. for 12 female swimmers, 13 to 18 years of age, when tested by running on a treadmill. His values are above the ones obtained in this study, where the mean max VO_2 for the control group for the initial test was 43.8 ml/kg-min. and 43.3 ml/kg-min. for the second test compared to 47.7 ml/kg-min. prior to the competitive season and 48.9 ml/kg-min. at the end of the experimental group's competitive season. However, the values in this study were obtained by subjects pedaling a bicycle ergometer, which may partly explain the reduction. The values of cycling are on an average 5 to 8% lower than those for running (Astrand, 1971).

The max $\dot{V}O_2$'s of the experimental subjects in this study were superior to the controls. The swimmers' max $\dot{V}O_2$ averaged 8.2% higher before training and 11.5% greater after training when compared on the basis of body weight. When expressed in liters/min. the experimental group had a max $\dot{V}O_2$ which was 10% greater than that of the control group before training and 13.5% higher after the training program. The difference between the experimental and control groups in terms of their max $\dot{V}O_2$ was greater in this study than that found between the Swedish champion girl swimmers and ordinary women, where only a 10% difference was displayed (Åstrand et al., 1963).

The maximal $\dot{V}O_2$ of 48.9 ml/kg-min. of the girl swimmers after training in this study is quite similar to the 51.5 ml/kg-min. reported by Åstrand et al. (1963) in their study of girl swimmers. According to the classification in Åstrand's nomograph (1960), the experimental girl swimmers are very close to qualifying for inclusion in the highest category (greater than 49.9 ml/kg-min.) The max $\dot{V}O_2$ achieved by the swimmers in this study indicates that the functional capacity of the cardiorespiratory system has adapted to the high metabolic demands of the training program during adolescence. This fact has been demonstrated by the achievement of world records in swimming by girls in their early teens.

Åstrand (1963) states that intensive training during adolescence results in a combination of "normal" body development and the effect of training so that the highest capacity for aerobic processes is reached at an earlier age. According to Åstrand (1952), development during early adolescence in girls normally leads to a great increase in the aerobic capacity from 1.7 l/min. in 10 to 11 year-olds to 2.6 l/min. in 14-15 year-olds. In relation to body weight, the max $\dot{V}O_2$ decreases by an average of 12% if the older girls are compared with the younger ones. A 12% decrease in max $\dot{V}O_2$ when expressed in ml/kg-min. was observed between the older and younger swimmers in this study.

Max $\dot{V}O_2$ is said to be the best single measure of physical fitness (fitness being defined as the ability to do aerobic work). Motivational factors were minimized by requiring that the subject continue until the heart rate approached 200 b/min. or until the subject could no longer continue at 60 rpm. The most accepted criteron that a near maximal level of O_2 uptake levels off, failing to increase with an increase in work load. This plateau was noted in 3 of the control subjects and none of the experimental subjects. The observation was made that the subjects used mostly leg and hip muscles with moderate loads, but at the extreme workloads they strained with their entire bodies by bracing the hands on the handle-bars to get leverage and swinging the body weight from one leg to the other. The level of O_2 uptake with bicycle exercise may depend on how willing the subjects are to stress themselves this intensely. For as long as the subject can recruit more muscles to perform the test, the greater should be the diversion of oxygen from the nonworking muscles to the exercising areas. The arteriovenous oxygen difference will increase and so should the O_2 uptake. However, it is possible that with bicycle exercise loading, certain muscle groups are brought to their maximum before the max $\dot{V}O_2$ is attained. This complaint was displayed by a feeling of intense local discomfort in the thigh muscles during the maximum work levels, and may have

been a factor in limiting the subjects' ability to perform more work during the bicycle ergometer test.

Pulmonary ventilation in relation to oxygen consumption appeared to be similar in the experimental and control groups up to a level of 70 to 80% of the max $\dot{V}O_2$. At this level the hyperventilation characteristic of heavy work began, and was more pronounced in the control group than in the experimental subjects. The noted difference in the pulmonary ventilation was significant between the experimental and control groups at maximal levels.

The maximal respiratory exchange ratio (max R.E.R.) was statistically higher in the control group as compared to the experimental group. Most of the R.E.R.'s of the control group were above unity and, therefore, indicated that lactic acid was being thrown into the blood during the work period. Lactic acid is produced by the muscles when the work is heavy enough to require a greater anaerobic liberation of energy than the alactacid process can furnish (Newnam et al., 1937). Of interest is the fact that the R.E.R.'s were lower in the experimental group, probably due to the chronic training program. The lower R.E.R.'s of the swimmers indicates that either the reconversion of lactic acid into glycogen was more adequate during work, or that the muscles were better buffered so that less lactic acid escaped from them during the exercise.

The energy yield from the aerobic pathway, reported in cal/kg, between the experimental and control groups was not significant after the training program. One would expect that the maximal aerobic capacity would not increase in the control group since the controls did not increase their daily activity. The slight increase in the maximal energy yield from the aerobic pathway of the experimental group was an indication of their already partially developed level of cardiorespiratory fitness.

The maximal alactacid energy capacities reported for the subjects in this study were less than those reported by Margaria (1963). The maximal alactacid capacity as reported by Margaria was approximately 100 cal/kg., whereas in this study it was found to be only as high as 88.7 cal/kg. of body weight after training. Between groups, a non-significant difference was noted.

Likewise, there was a nonsignificant difference in the maximal alactacid and lactacid energy capacities between the two groups. The same observation was true for both groups when comparing the before and after training values. These values, however, reveal the large energy contribution by the anaerobic mechanism to the total energy production.

Blood lactate concentration is often used to calculate the amount of lactate produced as an index of anaerobic work. According to Linde (1963), when the blood lactate rises above 65%, the max VO_2 has been reached and anerobic metabolism is being carried out. Therefore, the achievement of this level of blood lactate can be used as a measure of maximal motivation. Trained athletes can achieve higher levels of blood L.A. concentration during maximal exercise, probably due to their increased motivation. The state of physical fitness is also demonstrated by the fact that the trained individual can perform more work before her blood lactate reaches or exceeds 65mg.%. Eriksson (1971) reports that after heavy exercise in children a low L.A. concentration is a common finding. In the present study it was shown that the L.A. concentration in exercising muscles at maximal work was low.

(Swimmers = 40 ± 15 mg %, control = 59 ± 26 mg %). However, the subjects in this study were not using their total body mass in the performance of the maximal bicycle ergometer test. Therefore, the L.A. which was produced by the working leg muscles would diffuse throughout the body, resulting in a low total body L.A. concentration.

Exercise H.R. values for the swimmers were lower at all metabolic levels when compared with the control group. This observation is a well-known characteristic of trained individuals. For a similar increase in O_2 consumption, the control group displayed a greater increase in H.R. than did the experimental group, which is also in accord with current knowledge.

Astrand (1970) has stated that there is no significant difference between the maximal H.R. of trained and untrained subjects. In this study it was found that training did not produce a significant change in the maximal heart rates of the experimental subjects. A nonsignificant difference was also displayed between the two groups.

Much emphasis has been placed in the past on H.R. recovery curves after strenuous exercise as an index of physical fitness. The present study revealed a nonsignificant difference in the heart rate recovery curves from maximal exercise, although the control subjects tended, on the average, to have slightly slower heart rate recoveries than the experimental group.

CONCLUSIONS

In conclusion, the lack of statistical change in the maximal oxygen consumption expressed in ml/kg-min. exhibited by the experimental group after the competitive training season reveals the considerable adaptation of the oxygen transport system which is maintained by the female age-group swimmers throughout their training program. At the time of the pre-training evaluation, the swimmers had just finished a very intensive summer training program. The chronic exercise engaged in by the age-group swimmers had caused adaptation of the oxygen transport system, as revealed by the maximal oxygen consumption, to near peak levels. However, continued training appears to give the swimmers the ability to come closer to their maximal level of oxygen consumption during swimming and to maintain this level for a longer period of time. The slight increase in maximal oxygen uptake experienced by the experimental group after the training period (47.7 ± 5.2 to 48.8 ± 3.4 ml/kg-min.) may be attributed to growth.

The 13% difference in max $\dot{V}O_2$ (ml/kg-min.) between the experimental and control groups (47.7 ± 5.2 vs. 43.8 ± 6.2 and 48.9 ± 3.4 vs. 43.3 ± 4.8) may be partially due to heredity. However, the difference can most likely be attributed to the adaptation of the oxygen transport system as a result of the chronic heavy physical training program engaged in year after year by the female age-group swimmers.

Based on the results of the present study, it is concluded that the female age-group swimmers possess a significantly superior oxygen transport system as compared to the untrained controls of the same age. In addition, due to the chronic heavy physical training program engaged in by the female age-group swimmers, this high level of aerobic fitness is maintained throughout the year. Therefore, the development of swimming speed in mature trained endurance athletes will depend on the contribution of factors other than aerobic capacity.

Chronic, Intensive Physical Training and Cardiac Function in Female Swimmers

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Of great concern to physical educators and coaches involved in intensive, chronic swim training of 9-16 year old female swimmers, are the changes in physiological functions elicited in the maturing body. The question often posed is whether this ultra-organized, highly stressful training causes detrimental changes in the heart and its functioning.

Studies on adolescent female swimmers (3,4,11) have shown that the body responds more strongly to training during puberty, and that swim training accelerates changes in functional dimensions in proportion to the intensity and volume of training. Previous work of Astrand seems to indicate the possiblity that specific physical and functional changes accompany extensive volume training in young female swimmers. Indicative of ventricular hypertrophy, these changes manifest themselves as increased heart volumes and variances in the electrical activity of the heart. The largest increase in any of the functional dimensions measured in Astrand's swimmers was in heart volume, which increased in some cases by 50-60% as compared to body size (4). Vector analyses of the electrical activity of the hearts of endurance athletes have shown magnitudes indicative of ventricular enlargement (2). Hypertrophy also has been evidenced by significant differences in spatial QRS vectors, and greater magnitude of QRS vectors (8).

It was the purpose of this study to compare cardiac function of nine highly trained female swimmers with that of a control group of the same anatomical age, but inactive in aerobic training. The focus of the investigation centered on cardiac electrical response as monitored, noninvasively, by the vectorcardiogram, and heart volume determinations as calculated from chest x-ray.

A difference between groups on these measures would elucidate the functional effects of physiological maturation elicited through athletic training.

Methods and Results

The study was conducted on an experimental group of nine female swimmers, ages 9-17 years, who engaged in high intensity, interval-based workouts six days per week, averaging workout distances of 12,000 meters per day, and a control group of eight female students from the same schools as the swimmers, who did not engage in any type of endurance training.

To control growth and maturation, the groups were matched by skeletal wrist x-rays, ponderal index, and body surface area.

Assessments of cardiac function were made from x-ray determination of heart volume and measurement of QRS and T vectors from vectorcardiograms. All noninvasive data were gathered by a cardiologist in the Noninvasive Laboratory of the University Hospital, Columbus, Ohio.

Experiment 1

Method

To assess heart volume, posterior-anterior and lateral chest x-rays were taken on 14" x 17" film at a distance of 183 cm. For the PA x-ray, the subject faced the cassette with elbows flexed, hands on hips, and shoulders rolled forward. The top edge of the film was two inches above the shoulders and the x-ray beam directed one inch above the center of the film. The lateral view was taken with the cassette the same height and the x-ray beam directed as in the PA. The subject stood with her left side nearest the film and with arms extended overhead. Both exposures were taken in deep inspiration. The x-rays were read by a radiologist and heart volume calcualted by the formula: V=L x B x D x K as described by Keats and Enge (9).

Results

Independent t tests were employed to compare absolute heart volume, heart volume/kilogram body weight, and heart volume/body surface area. None of the t's was significant ($p > .05$). Correlation-regression analyses were computed for heart volume vs. kilogram body weight and heart volume vs. body surface area. Although all of the correlation coefficients for both swimmers and controls were significant, analyses of covariance to determine differences in slope and elevation of the regression lines showed no significance. Therefore, the heart volumes of the swimmers were not significantly larger than those of the control.

Experiment 2

Vectorcardiographic data were collected on the experimental group before the competitive season and at the peak of the season. Testing on the control group occurred at a time coincident with the second testing of the swimmers.

Method

The Frank System was used to record the direction and magnitude of successive instantaneous spatial QRS vectors as projected on the frontal, horizontal, and sagittal planes. The subject assumed a recumbent position and the eight elctrodes were applied according to Frank electrode placement (Hewlett, 1967).

Apparatus

The recording apparatus consisted of a Hewlett-Packard Vector Programmer (1507-A) and a Hewlett-Packard Model 780-6A Viso-Scope to which a Polaroid camera was attached. The vector loop was interrupted every 0.0025 second, producing a resultant line in the form of a tear-drop. Multiple photographs were taken of each of the planar projections with increased amplification when necessary. Care was taken to avoid superimposition of P and T loops and to obtain exact recordings of the isoelectric point. When necessary, the technique of "E"-point shift was used.

The direction and magnitude of the maximum and mean QRS vectors in the frontal and horizontal planes were recorded. The T loop in the frontal and horizontal planes was analyzed for the direction and magnitude of the maximum vector only.

Left ventricular hypertrophy was assessed according to the criteria established by Chou, Helm, and Kaplan (5). Hypertrophy was considered present if the voltage of the mean deflection in the horizontal plane exceeded 1.5 millivolts. Mean axes on the frontal and horizontal planes were measured on polar coordinates drawn through the isoelectric point, and considered within the normal range if they fell between -30° and $+110^{\circ}$.

Results

The *t* ratio for independent groups showed no significant differences ($p > .05$) between the two groups in direction of the maximum QRS vector or maximum T vector in the frontal and horizontal planes. There was likewise no difference in voltage of the maximum and mean QRS vector in the horizontal plane or the mean QRS vector in the frontal plane. There was, however, a significant difference ($p < .05$) between the group in voltage of the maximum QRS vector in the frontal plane. None of the subjects demonstrated a mean QRS vector of sufficient voltage to suggest left ventricular hypertrophy, and all subjects fell within the normal range on polar coordinates.

Dependent *t* tests for single samples were applied to pre and peak season data of the swim group to determine significant changes in the voltage of the mean and maximum QRS vectors in the frontal and horizontal planes that could be attributed to training. Results showed a significant ($p < .01$) increase in the voltage of the maximum QRS vector in the frontal plane, and a tendency ($p < .10$) for the mean QRS vector in the frontal plane to increase.

TABLE 1

Results of Dependent *t* Tests
for Pre and Post - Season
Vectorcardiographic Data

Condition	Mean±s.d.		*t*	Level of Significance
Voltage of the Mean QRS Vector (mv)				
Frontal plane	0.186±	0.285	1.963	$p < .10$
Horizontal plane	-0.019±	0.244	-0.241	N.S.
Voltage of the Maximum QRS Vector (mv)				
Frontal plane	0.163±	0.129	3.837	$p < .01$
Horizontal plane	-0.039±	0.290	-0.409	N.S.

Discussion

Within the scope of this study, it appears that intense volume training of young female swimmers does not elicit greater heart volumes than would be expected from growth, nor does it cause increased magnitude of QRS or T vectors sufficient to warrant concern for ventricular hypertrophy.

Although the heart volumes of the swimmers were not significantly larger than those of the controls, the tendency toward greater size is of interest, and is consistent with previous findings. Astrand (3) found heart volumes in girl swimmers significantly increased in excess of that expected from an age-dependent increase in body size. The volumes were most highly related to maximal oxygen uptake, which would indicate progressively greater adaptations to myocardial hypoxia as training volume and intensity increased. Implications would indicate a larger stroke volume coupled with a larger heart volume. However, it has been suggested (1) that this coupling is characteristic of the trained adult athlete, and apparent only in post-pubescent years. Were this true, it may explain the failure to find significance between the two groups of the present study, each composed of pre- and post-pubescent subjects.

Due to the small number of subjects, generalizations to the population of female swimmers cannot be made from vectorcardiographic evidence. However, results are such as to encourage hypotheses and substantiate previous findings.

Although none of the subjects demonstrated a maximum QRS vector of sufficient voltage to suggest left ventricular hypertrophy, there was a significant difference between the swim and control groups in voltage of the maximum QRS vector in the frontal plane. This would suggest greater ventricular mass in the swim group, resulting from physiological enlargement of the myocardial fibers. The duration of the QRS would presumably be increased since it would take the activation wave longer to get through the ventricles (6). However, there was no significant difference in QRS duration between swimmers and controls on 12-lead electrocardiograms. This leads to the hypothesis of a simultaneous increase in conduction rate with the growth of fiber diameter. This seems plausible since in adulthood the QRS duration does not exceed twice its value at birth, although the heart experiences a 15-fold increase in weight (6).

The fact that significance was shown for the voltage of the QRS vector in the frontal and not horizontal plane may suggest no significance, in essence. The great involvement of upper body musculature required in swimming, and the hypertrophy or respiratory muscles developed to combat the pressures of immersion (1), results in a thicker chest wall. This increased muscle mass could dampen the results measured by the surface electrodes of the Frank lead system. The dampening effect would be more pronounced in the horizontal plane since it reflects electrical activity in the antero-posterior axis, while the frontal plane does not. Too, Young (12) reported the vector loops in the frontal plane to display the greatest variability in children.

No significant difference between the groups was found in direction of the maximum T or maximum QRS vector in either the frontal or horizontal plane.

This is congruent with Hugenholtz's (7) assertion that since the relative proportions of the heart and chest-cage change little from infancy to late childhood, any change in vectors after age one would affect magnitude rather than direction.

It is concluded, therefore, that the functional adaptation of young female swimmers to chronic, intense swim training appears to be greater than any physical change, or unable to be predicted from resting data.

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The Effects of Chronic Heavy Exercise on the Systolic Time Intervals and Heart Volume of Male Age Group Swimmers

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During the past twenty-five to thirty years, our country has witnessed a tremendous growth in the field of competitive athletics. This is true not only on the professional and intercollegiate level, but also on the high school, junior high school, and elementary school level.

Whatever the sport, the training is a much more serious business than it was even a few years ago, and in no other sport is this more true than in the sport of age group swimming.

Today modern training techniques for age-group swimmers require that the youngsters train virtually twelve months out of the year, at times swimming as much as 12,000 to 14,000 meters per day.

If the ultimate purpose of these training programs is to benefit the children involved, both now and in the future, is it not wise to ascertain the effects such programs have on the athletes?

Granted that research in the area of the cardio-vascular system has received considerable emphasis in recent years, nevertheless a major portion of this research has been interpreted in terms of cardiac disorders, and relatively little in terms of the effects of physical training on cardiac responses.

It was the purpose of this study to investigate the effects of chronic heavy exercise on the heart-volume, left ventricular function, and left ventricular hypertrophy in 10 male age group swimmers (9-17 years) by comparing their results to those of the control group.

Method

The experimental group consisted of 10 trained male subjects (9-17 years of age) selected from the Upper Arlington Swim Club. Nine male students (9-17 years of age) from the public schools in Upper Arlington, Ohio were selected for the control group based on skeletal age, ponderal index and body surface area. An independent t-test revealed no significant differences ($p < 0.05$) between the two groups in these areas (Table 1). In addition, members of the control group did not actively participate in cross country, swimming or other highly aerobic activities.

Table 1
Differences in Vital Data Between
Swimmers and Controls

Condition	mean ± s.d.	t	Level of Significance
Chronological Age			
Controls	13.4 ± 2.4	0.412	N.S.
Swimmers	13.9 ± 2.7		
Skeletal Age			
Controls	13.5 ± 3.2	0.116	N.S.
Swimmers	13.7 ± 3.5		
Height (cm)			
Controls	159.0 ± 15.5	0.326	N.S.
Swimmers	161.8 ± 19.5		
Weight (kg.)			
Controls	51.0 ± 16.2	0.304	N.S.
Swimmers	53.7 ± 20.2		
Ponderal Index			
Controls	13.1 ± 0.4	0.583	N.S.
Swimmers	13.3 ± 0.4		
Body Surface Area			
Controls	1.50 ± 0.30	0.299	N.S.
Swimmers	1.55 ± 0.38		

During their season the experimental group trained six days a week, frequently performing more than one workout per day. The principles of interval training were employed in conjunction with high intensity swimming, with total distances of 12,000 - 14,000 meters per day not uncommon.

Following the final swimming meet of the season the cardiac function tests were performed on all subjects at the Non-Invasive Laboratory in the Cardiology Department of University Hospital, Columbus, Ohio. The data collected from each group consisted of resting systolic time intervals to determine left ventricular function in addition to heart volume, which was determined by means of posterior-anterior (PA) and lateral chest x-rays taken at The Ohio State University Health Center.

In order to determine left ventricular function three systolic time intervals were measured. These were: (a) total electromechanical systole (Q - S_2), the interval from the onset of ventricular depolarization to the initial high frequency vibrations of the second heart sound, (b) left ventricular ejection time (LVET), the interval from the beginning upstroke to the incisural notch on the carotid arterial pulse tracing, and (c) pre-ejection phase (PEP), the interval from onset of ventricular depolarization to the beginning of left ventricular ejection.

These intervals were measured on each subject from simultaneous recordings of the electrocardiogram, phonocardiogram, and tracings of the carotid arterial pulse wave, while he rested on a bed in the supine position.

In order to measure the systolic time intervals vertical lines were drawn through the significant points on the processed tracings of the carotid pulse wave, electrocardiogram, and phonocardiogram.

Calculation of heart volume was done by the use of chest x-rays taken in the posterior-anterior (PA) and left lateral position.

The PA x-rays were taken with the subject facing the cassette at a distance of 72 inches (183 cm) from the x-ray tube. For the left lateral x-rays the subject stood at right angles to the cassette with his left side nearest the film, and his arms extended over his head. Both exposures were made on deep inspiration.

The x-rays were read by a radiologist at The Ohio State University Health Center according to the procedure outlined by Keats (10). The length diameter (L) was measured from the junction of the superior vena cava and right atrium to the cardiac apex. The broad diameter (B) was measured from the junction of the right atrium and the diaphragm, and the junction of the pulmonary artery and left atrial appendage. The third dimension, (D), represented the greatest horizontal depth of the cardiac shadow. The L and B measurements were taken from the PA x-ray, while the D measurements were taken from the left lateral x-rays. All measurements were reported in centimeters.

The heart volume was then determined by use of the formula: $V = L \times B \times D \times K$. The constant K represented the product of an ellipsoid area factor and a correction factor for magnification of the cardiac image. The K value used for a focal-film distance of 183 centimeters was 0.42.

Results

Table 2 shows there were no significant differences in the time duration (milliseconds) at rest between the swimmers and controls in regard to their systolic time intervals.

Table 2
Differences in Systolic Time Intervals
Between Swimmers and Controls

Condition	mean $\pm$ s.d.	t	Level of Significance
QS_2			
Controls	382.1 ± 13.2	0.251	N.S.
Swimmers	384.5 ± 24.9		
LVET			
Controls	285.8 ± 11.5	1.053	N.S.
Swimmers	294.0 ± 19.9		
PEP			
Controls	96.3 ± 11.2	1.211	N.S.
Swimmers	90.5 ± 8.1		

In comparing the absolute heart volume, heart volume/kg. body weight, and heart volume/body surface area there was no significant difference between the swimmers and the controls (Table 3).

Table 3
Differences in Heart Volume (ML.)
Between Swimmers and Controls

Condition	mean ± s.d.	t	Level of Significance
Heart Volume			
Control	534.7 ± 164.9	0.484	N.S.
Swimmers	579.0 ± 211.5		
Heart Volume/ Kg. Body Weight			
Control	10.5 ± 0.65	1.098	N.S.
Swimmers	10.9 ± 0.84		
Heart Volume/ Body Surface Area			
Control	384.8 ± 42.6	0.679	N.S.
Swimmers	363.4 ± 45.9		

Discussion

The lack of a significant difference between the resting systolic time intervals of the swimmers and controls would appear to disagree with the findings of Gandee (7). He noted a significant difference in the resting systolic time intervals of 10 adult males (18-24 years) after a seven week interval training program. However, he used the same subjects and noted the change in their systolic time intervals after seven weeks of training. In the present study the swimmers and controls were tested only at the end of the competitive season.

It is difficult to say whether the effects of training on the swimmers' systolic time intervals were negated because of the large variance in age among the group, or in the number of years of training, or a combination of the two.

When the heart volume of the swimmers and controls were compared as regards either absolute heart volume, heart volume/ kg. body weight, or heart volume/body surface area, it was surprising to find that although the heart volume of the swimmers was slightly larger in all three cases, this difference was not significant. This disagrees with past findings (1, 5, 6, 8, 9) in which the heart volume of adult endurance type athletes was reported to be larger than that of their nonathletic counterparts. However, Ekblom (4) in his study on six 11 year old boys failed to notice any significant difference in heart volume between them and seven boys of the same age until after three years of training. Differences between the groups in heart volume after 6 and 26 months of training were not significant. Therefore, the failure of the swimmers in the present study to show a significantly higher heart volume possibly was due to the variance in the number of years they have trained.

It was concluded from this study that there was no significant difference in the systolic time intervals of the swimmers and controls, and the chronic heavy training of the swimmers did not bring about any significant difference between the heart volume of the groups when comparing either absolute heart volume, heart volume/kilogram body weight, or heart volume/body surface area.

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Chronic Heavy Physical Training and Metabolic Effects on Male Age Group Swimmers

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Over the years participation in age group swimming programs in the United States has increased steadily. One estimate places the number of U.S. competitive swimmers now in active training at one and one half to two million. This swimming growth period has been paralleled by changes in basic training programs. Some of these training innovations cited by Bartels (1974) are:

(1) the use of interval training in the preparation of swimmers for competition, (2) a great increase in total training distances per average training day, and (3) an increase in the average number of workouts per week across per week across a training year.

Shephard (1971) in an excellent review of publications dealing with the physical working capacity of children has noted the lack of available research concerning adolescent athletes. When adolescent competitive swimming is considered, research becomes even more scarce.

The fact that swimming training causes adaptation of the oxygen transport system is well documented (Andersen & Magel, 1970; Andrew et al., 1972; Cunningham & Eynon, 1973; Holmer, 1972; Holmer & Astrand, 1972; Sobolova, et.al, 1971). However, results of the effects of the now popular interval training in the form of chronic heavy exercise on age group swimmers are not common. Most research involving swimming training in adolescence is of a descriptive nature (Andersen & Magel, 1970; Andrew, et.al., 1972; Cunningham & Eynon, 1973; Sobolova et.al., 1971). Cunningham and Eynon (1973) have reported on the physical working capacity of young competitive swimmers engaged in heavy training programs. However, these subjects averaged five training sessions per week covering distances of 2,118 to 3,194 yards per session. This undoubtedly places a stress on the oxygen transport system but falls far short of the 12,000 meter workouts common to seriously training swimmers.

With such a vast number of swimmers undergoing high intensity training in the form of chronic heavy exercise at such an early age, an investigation was needed to examine the resulting physiological effects. Due to the success of outstanding swimmers using these vigorous training programs, it is often assumed beneficial for all participants. However, as yet this has not been substantiated by relevant research. It was the specific purpose of this study to scientifically appraise the effectiveness of such a training program on thirteen male age group swimmers from 10 to 17 years of age.

METHODS

The experimental group consisted of 13 trained males ranging in age from 9-16 years and chosen from the Upper Arlington Ohio Swim Club. Thirteen male students from the public schools in Upper Arlington, Ohio were matched and formed the control group.

Members of this control group did not actively train in highly aerobic activities. The experimental group trained six days a week for five months, with more than one workout per day not uncommon. The principles of interval training were employed in conjunction with high intensity swimming. Total distances approaching 12,000 meters were periodically covered in one day.

During measurement of maximal aerobic capacity (Klint & Voigt, 1971; Skinner et.al, 1971), the subject rode a Jacquet Universal Bicycle Ergometer at 60 revolutions per minute with varying workloads. The maximal oxygen consumption test consisted of three exercise periods, each 4 minutes in duration. These exercise periods were designed with progressive increases in workload to achieve maximal oxygen consumption during the last ride. Initial wattage on the bicycle ergometer for the first exercise period was determined on the basis of heart rate achieved during the orientation practice ride. Wattages were adjusted during and between exercise periods to produce a heart rate of approximately 150-160 beats per minute (bpm) for the first ride, 170-180 (bpm) for the second ride and 190-200+ (bpm) for the third ride. Recovery time between exercise periods was 10 minutes. The subject recovered sitting in a chair adjacent to the bicycle ergometer. Oxygen consumption was measured by the open circuit method. Using three leads from a Hewlett-Packard electrocardiograph, heart rate was monitored during the rest, exercise and recovery periods. Pulmonary ventilation ATPS during the highest minute of oxygen consumption was read and recorded directly from the Cowan CD-4 gas meter. The volume was then converted to pulmonary ventilation BTPS.

RESULTS

The experimental swimming group significantly ($P < .001$) exceeded the control group in $\dot{V}O_2$ max (ml/kg-min) both before and after the five month training time period. When this same variable was considered after the training period the swimmers and the control group exhibited no significant increase. Maximal heart rate was significantly higher ($P < .05$) after training in the swimmers but no differences occurred between groups. Maximal pulmonary ventilation (l/min BTPS) remained virtually the same for both groups after the training time period with the swimmers exhibiting significantly higher ($P < .05$) values during the pre-training and post-training evaluations.

DISCUSSION

The lack of statistical change in maximal oxygen consumption exhibited by the experimental group after training reveals the considerable adaptation of the oxygen transport system maintained by these age group swimmers throughout their year-round training program. At the time of the pre-training period evaluation, the swimmers had recently finished a very intensive summer training program. It should be mentioned that the chronic exercise engaged in by these age group swimmers may have caused adaptation of the oxygen transport system, as revealed by maximal oxygen consumption, to near peak levels. However, it is also possible that this continued training gives the swimmers the ability to perform closer to this maximal level of oxygen consumption during competition and to maintain this level for a greater period of time. The highly significant 20 percent difference in maximal oxygen uptake between the swimmers and the control group may be due in

part to heredity but most of the difference is normally credited to adaptation of the oxygen transport system as a result of the chronic heavy physical training engaged in year after year by the experimental group. However, limitations inherent in the design of this study prevent a clear conclusion that heredity and/or training is responsible for this large difference in maximal oxygen consumption between the swimmers and the control group.

Results published by Andersen comparing adolescent swimmers to untrained subjects support these findings. Values for the control group in maximal oxygen consumption obtained during this study are comparable to those reported by Seliger (1971) on the Czechoslovak 12 and 15 year old population and Skinner on American boys 6-15.5 years of age. Results obtained from the experimental group were in agreement with the findings of Wells (1973) on teenaged athletes, Ekblom (1969) on trained age group swimmers.

Training is postulated to either decrease or not affect maximal exercise heart rate. After training, however, the swimming group significantly increased maximal heart rate. Since the experimental group was already in a highly trained state before the training period began, a significant change in heart rate was not anticipated. The significant increase in heart rate found in the experimental group is partially due to the considerable increase in pulse rate of three subjects. Upon examination, it appears that the post-training period average maximal heart rate was not high but that the pre-training period average heart rate was low. This could be due to local leg fatigue on the bicycle ergometer before heart rate could climb to maximal levels. However, this local fatigue did not appear to interfere with the subjects achieving maximal oxygen uptake since the pre-training period and post-training period values are consistant with the remainder of the experimental group.

Heart rate values for the swimmers were lower at most workloads when compared to control subjects of approximately the same age and body size. Similarly, the control group experienced a greater increase in heart rate per increase in oxygen consumption when comparisons were made with the swimming group. A greater maximal stroke volume is commonly found in trained swimmers. In addition, trained swimmers often reach maximal stroke volume at 35 to 40 percent maximal oxygen consumption while untrained adolescents often reach 50 percent maximal oxygen consumption before maximal stroke volume is attained.

On the basis of the data obtained from this investigation, it was concluded that these age group swimmers possess significantly higher aerobic power than untrained males of the same age. In addition, it is possible that due to chronic heavy physical training, this high level of cardiovascular fitness may be maintained throughout the entire training year.

FURTHER RESEARCH

While our research study revealed numerous vital and interesting data, it, like most investigations also revealed the need for further research. It is obviously clear that highly trained age group swimmers possess significantly higher aerobic capacities than their untrained peers. However, a fundamental question remains unanswered. Are the high aerobic capacities possessed by these age group swimmers due to the chronic heavy physical training or are they due to the genetic endowment of these athletes? Perhaps it is a combination of heredity and training. We cannot

answer that question without speculation.

Therefore, there is need for a longitudinal study involving several age group swimmers each assessed before participation in a swimming program is initiated and followed closely with periodic re-assessment throughout their entire competitive careers.

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TABLE 1. Maximum values obtained during metabolic testing

Swimmers	Max VO_2 l/min. Pre	Post	Max VO_2 ml/kg-min. Pre	Post	Heart Rate Pre	Post	VE_{BTPS} l/min. Pre	Post
X	3.29	3.47	56.0	57.4	193	198	113.2	113.3
SD	1.07	1.06	6.6	5.3	8	8	40.2	38.3
Controls								
X	2.50	2.70	46.2	48.5	194	194	85.9	85.3
SD	0.72	0.85	4.0	4.0	5.7	7.5	27.9	23.1

Research Related to the Implementation of Jogging Programs

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INTRODUCTION

The implementation of jogging programs involves several important considerations: proper medical evaluation and fitness testing; individual exercise prescription based on current health status, needs, interests, goals, and abilities; knowledge of exercise principles pertaining to frequency, duration, intensity, and mode; and follow-up involving fitness tests as a progress check and adjustment of the exercise prescription as a result of individual adaptation. The objective of this presentation is to review research related to the frequency, duration, intensity, and types of jogging programs and their resulting attrition and injury rates. An excellent summary is available from Pollock (1973) which quantifies training and relates the changes in fitness with frequency, duration, and intensity of training. Several studies are available on the topics listed above; however, only a few will be presented here to exemplify the principles for implementing a jogging program.

FREQUENCY

Gettman et al. (1976) showed that the cardiorespiratory (CR) responses of men to 1, 3, and 5 day/week conditioning programs improved in direct proportion to the frequency of training. County jail inmates ($\bar{X}$ age = 24 yrs) were evaluated before and after a 20-week program utilizing motorized treadmills located in a specially built air-conditioned laboratory. The duration and intensity of each exercise session were held constant at 30 min and 85 to 90% of maximum heart rate (HR) range (Karvonen et al., 1975), respectively. The mode of exercise consisted of endurance-oriented running and walking with the run-to-walk ratio increasing significantly with advancing weeks of conditioning. Energy costs for the 1, 3, and 5-day programs averaged 324, 349, and 366 kcal/workout, respectively.

Performance times on the Bruce maximal stress test (1971) increased in direct proportion to frequency of training with the 1-day group improving 11%, the 3-day group 17%, and 5-day group 21%. Maximum oxygen uptake ($\dot{V}O_2$ max - ml/kg·min) improved 8%, 13%, and 17% for the 1, 3, and 5-day groups, respectively. Max O_2 pulse increased similar to results reported by Jackson et al. (1968), Pollock et al. (1969a), Pollock et al. (1969b), and Pollock et al. (1974).

Percent body fat changed significantly only in the 5-day group. Trends of fat loss were seen in the other two groups but the non-significant changes could have been due to the initial low values of body weight (73.0 kg) and fat (13.0%) and the lower total energy expenditures per week. Other studies have shown consistent body weight and fat reductions with regimens conducted at least 3 days/week.

DURATION

Milesis et al. (1976) have shown a direct relationship between the degree of improvement in CR function and the duration of the training session. State prison inmates ($\bar{X}$ age = 28 yrs) trained for 20 weeks in either 15, 30, or 45-min duration programs. Frequency and intensity of training were held constant at 3 days/week and 85 to 90% max HR range (Karvonen et al., 1957). The conditioning programs were conducted on a 440-yd asphalt track and consisted of alternate bouts of running and walking, with more running and less walking as the training progressed. Energy costs for the 15, 30, and 45-min programs averaged 180, 336, and 482 kcal/workout, respectively.

The improvements in the Bruce maximal stress test performance times were in direct proportion to duration of training; 9, 13, and 18%, respectively. $\dot{V}O_2$ max results showed significant increases in the three groups; 8, 16, and 17%, respectively. All CR improvements for the training groups were significantly different from a control group. Studies by Shephard (1968), Wilmore et al. (1970) and Yeager & Brynteson (1970) have also shown duration of training to be a significant factor in improving CR fitness.

Significant decreases in percent body fat occurred in all three training groups. In addition, body weight decreased significantly for the 30 and 45-min groups in spite of the relatively lean condition (body fat = 13%) of the subjects at the beginning of the experiment.

Time often has been a primary constraint in implementing physical training programs; if so, the findings of Milesis et al. (1976) showed that a high intensity program of 15 min duration conducted 3 days/week had considerable merit. However, greater fitness improvements were shown in the 30 and 45-min programs; therefore, if time were not a critical factor, these programs would be preferable.

INTENSITY

Karvonen et al. (1957) conducted a classical study on intensity of exercise. They trained young men for 30 min, 5 times per week on a treadmill and found no significant improvement in working capacity unless sustained training heart rates were greater than 135 beats/min. Hollman and Venrath (1962) found similar results with bicycle ergometer training; i.e., sustained HR greater than 130 beats/min were needed to stimulate significant training response. The above results indicate that young men must exercise at least at 60% of their HR range (max-rest). Åstrand, (1970), and Davis & Knibbs (1971) state that one should train at approximately 50% of his $\dot{V}O_2$ max in order to gain significant improvements in endurance. This agrees with the studies on HR since 50% $\dot{V}O_2$ max roughly corresponds with 60% max HR range (Taylor et al., 1969).

Shephard (1968) concluded that intensity and duration were the most important training stimuli in a study where men were trained at 96%, 75%, and 39% of $\dot{V}O_2$ max; 5, 3, and 1 days/week; and 20, 10, and 5 min/session. He stated that a high intensity threshold was necessary for young, active individuals and that a lower threshold would be effective in sedentary middle-aged and older groups. This was supported by Gledhill & Eynon (1972) who showed that a high fitness group did not improve in $\dot{V}O_2$ max

when trained at a HR of 120 beats/min, yet a low fitness group improved significantly.

Pollock et al. (1977c) found that 20 weeks of high intensity running at 94% max HR range improved $\dot{V}O_2$ max significantly (20%) in men 30 to 40 years of age. Furthermore, cardiorespiratory (CR) fitness was maintained in a subgroup for a 6-week period following the initial 20 weeks of training by decreasing the intensity to 84% max HR and increasing the duration of training by 2 min/session. This equalized the average daily energy cost of the 6-week follow-up program with the previous 20-week program. Another subgroup agreed to stop training after the initial 20-week program and they showed significant decreases in CR fitness. One implication of the study was that high intensity efforts are not necessary to maintain CR fitness in middle-aged men.

MODE

In a study with young police officers ($\bar{X}$ = 29 yrs), Pollock and Gettman (1977b) showed similar cardiorespiratory improvements in interval, continuous and combined interval/continuous running programs. The 20-week running programs were conducted 3 days/week and were designed so that the total kcal energy costs of all three programs were similar (341 kcal/workout). The interval group alternated 220 yds running with 220 yds walking while the continuous group progressed from equal distances of walk/jog initially to jogging approximately 3 miles continuously. The combined group alternated days of interval training with the continuous program. The interval group averaged 30 min/workout at 92% max HR whereas the continuous group and combined groups averaged 26 and 28 min/workout at 84 and 83% max HR, respectively.

The results showed that all three groups improved to similar degrees in $\dot{V}O_2$ max; 12, 15, and 10% for the interval, continuous, and combined, respectively. Reductions in body fat were also similar for all three groups (10, 10, and 7%, respectively). All changes were significant when compared to a control group. It was concluded that any of the three training regimens would be successful for improving physical fitness so long as the total calorie expenditure is similar. When the men in the combined group were asked their preference of running mode, 80% chose the continuous workouts. Less discomfort, fewer injuries, and lower dropout rates were experienced by the continuous program.

ATTRITION

The effects of varying frequency and duration of jogging on the attrition and incidence of injury have been reported by Pollock et al. (1977a). As shown in the studies on county jail inmates (Gettman et al., 1976), and state prison inmates (Milesis et al., 1976) cardiorespiratory fitness improved in direct proportion to frequency and duration of training. Injury occurred in 0, 12, and 39% of the 1, 3, and 5-day week groups and in 22, 24, and 54% of the 15, 30, and 45-min/workout groups, respectively. Attrition resulting from injury occurred in 0, 4, and 6% and in 0, 0, and 17% of the same respective groups.

Intensity has been indicated as a factor for injury and attrition in training (Oja et al., 1975 and Pollock et al., 1971); however, intensity was controlled at 85 to 90% max HR range for all groups in the inmate studies. Other factors that might affect the injury rate resulting from jogging programs include; age, height,

weight, fat, initial level of fitness, type of running shoe and surface, sharp turns, warmup, and certain basic structural problems related to the musculoskeletal system. Within each study subjects were of similar age, height, weight, fat and initial level of fitness. They also were issued the same type of running shoe and trained on the same track or treadmill. All subjects participated in the same warmup routine; therefore, it appeared that attrition and injury rate were directly related to frequency and duration of training.

It was concluded that although the 5-day/week and 45 min/workout groups improved most in cardiorespiratory fitness, they are not recommended programs for beginning joggers because of the significantly greater percent of injuries. The 3-day/week and 30 min/workout programs appeared to be optimal for improving fitness and minimizing attrition due to injury.

SUMMARY

Based on the research conducted with various aspects of walking, jogging, and running programs, the following table is presented to simplify guidelines for prescribing exercise.

GUIDELINES FOR AEROBIC EXERCISE PRESCRIPTION

FACTOR	LOW FITNESS LEVEL	AVE. FITNESS LEVEL	HIGH FITNESS LEVEL
Frequency (Days/Week)	3	3 or 4	5
Duration (Mins/Workout)	10-20	15-45	30-60
Intensity			
(% Max HR Range)	60-70	70-80	80-90
(% $\dot{V}O_2$ Max)	50-60	60-70	70-80
Mode* (Type of Exercise)	Walk, Jog Swim, Cycle	Walk, Jog Run, Swim Cycle	Jog, Run Swim, Cycle

* Other activities may be used provided they are continuous and rhythmical in nature.

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Relaxation Response: A Comparison of Several Relaxation Techniques

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In modern society, stress usually occurs in the form of psychosocial stressors or situations that demand a response. Many people respond inappropriately in kind and intensity and endure more stress arousal than is necessary. These individuals have been said to be sympathetically dominated or ergotropically tuned. As stimulation from stressors causes arousal, the following changes occur in the psychophysiology of such an individual: an increase in frequency and decrease in amplitude of brain waves, an increase in heart rate, an increase in respiration rate, an increase in muscle tension, a decrease in skin temperature, and an increase in anxiety (Gellhorn, 1968; Green, 1974). These responses trigger further physiological changes which are highly associated with hypertension, atherosclerotic heart disease, stroke, and other stress induced diseases (Benson, 1975; Friedman and Roseman, 1974).

Fortunately, all individuals have an integral mechanism to restore the body to equilibrium following stressful episodes. This mechanism was discovered by Hess, a Swiss physiologist who discovered a response in cats that occurred when certain areas of the limbic brain were electrically stimulated. Hess termed this response the trophotropic response. The response consists of a decrease in frequency and increase in implitude of brain waves, a decrease in heart rate, a decrease in respiration rate, an increase in skin temperature, a decrease in muscle tension, and a decrease in anxiety. If this response is elicited often enough, a shift will occur causing an individual to become more trophotropically dominated than ergotropically dominated. When this occurs, the individual is said to be trophotropically tuned (Gellhorn, 1968; Benson, 1975).

Recently, it was discovered that those who had habitually elicited the trophotropic response characteristically responded to a stressful event with greater arousal during the event and a quick return to normal following the event. Those who had not been trained in relaxing, while they did not show as great an arousal to the event, carried their arousal over after the event. This set up a situation where each arousing event in a person's day adds to the preceding level of arousal until anxiety or some other psychosomatic ailment surfaces (Goleman, 1976). Regular elicitation of the trophotropic response leads to increased trophotropic tuning which provides protection against the effects of stress.

While relaxation training is an important route towards the reduction of psychosomatic illness, there are many pathways that lead toward relaxation. Methods or techniques that have been used for relaxation include EMG biofeedback training (EMG BFT), progressive muscle relaxation (PMR), meditation, autogenic training, yoga, hypnosis, and massage. While some of these techniques are expensive to learn and take much practice to master, EMG BFT, progressive

muscle relaxation, and meditation training have attracted much attention as they are relatively easy to learn and produce rapid results. Thus, the purpose of this study was to investigate the relative effectiveness of EMG BFT, progressive muscle relaxation and meditation in producing a trophotropic state as measured by frontalis muscle tension, respiration rate, heart rate, electrodermal response, and skin temperature.

METHOD

Subjects: The subjects in this study were volunteers solicited from students enrolled in introductory Health Education classes at the University of Maryland. Of the fifty-four subjects, twenty-seven were female and twenty-seven were male with ages ranging from 18 to 28.

Apparatus: EMG activity was measured by three Beckman 15 mm. Ag/Ag Cl electrodes in standard placement on the frontalis muscle. A Coulbourn Instruments (CI) high gain bioamplifier with integrator and voltage controlled oscillator were used to quantify the EMG potentials.

Electrodermal response, skin potential level, was measured on the first and third fingertips of the nonpreferred hand with a reference electrode on the bony process of the second joint of the thumb. Electrical potentials were analyzed in the same manner as described for EMG.

Heart and respiration rates were measured using an IMI Infalarm with active electrodes placed bilaterally on the ninth ribs and a reference electrode placed high on the sternum.

Skin temperature was measured via a surface thermister placed on the second finger (palmar aspect) of the hand used for skin potential measurements. Temperature was measured by a Yellow Springs Institute Temperature Meter.

Cyborg J 33 portable trainers were used by the EMG biofeedback training group to learn control of frontalis muscle tension. The audio feedback of muscle tension was received through Realistic stereo headphones in the form of a series of clicks which were directly proportional in rate to the EMG activity.

Procedure: The study consisted of two pretest periods, ten 30-minute training sessions and a post test data collection period. The first two sessions were utilized as pretest periods and a period in which the subjects became accustomed to the laboratory environment. The A-state portion of the STAI was utilized to detect high state anxiety while the Personal Data Form was utilized to control for the effects of exercise, drug use, amount of sleep and the subject's personal assessment of emotional state. On occasion, subjects with perceived anxiety, little sleep, or recent drug ingestion were rescheduled. After preparation for measurement, subjects sat in a comfortable semi-supine position in an isolated room and were asked to relax while the data was collected at 30-second intervals until the data plateaued for five minutes. Following plateau of the frontalis EMG muscle scores data were collected on

all physiological parameters for ten consecutive 30-second time intervals. At this time the data collection was terminated and subjects were escorted from the room. An identical procedure was followed for data collection following relaxation training.

Following the preliminary procedures subjects were partitioned by gender and randomly assigned to treatment groups with equal numbers of males and females assigned to each group. The five experimental groups were as follows:

(1) Control group. This group had no required activities during the training phase, with the exception of not initiating training in any form of relaxation training.

(2) Placebo control group. This group listened to the Learning Dynamics, Inc. series of cassette tapes dealing with emotions entitled, "The Dynamics of Mood Control." Subjects listened to five cassette tapes entitled, "Your Moods and You," "How Moods Affect Your Life," "Depression and Loneliness," "Anxiety, Tension, and Worry," and "Frustration, Anger, and Agression" with each side of the tape constituting a training session. These tapes (ten in number) contained cognitive information about the effects of emotions and feelings in human life situations.

(3) Biofeedback training group. This group was given ten EMG BFT sessions of 30 minutes duration. During this training, subjects were prepped in the standard manner for BFT of the frontalis muscle and surface floating cup electrodes were applied over the frontalis muscle in the manner described above. During the training sessions, the subjects received audio-visual feedback from the Cyborg J33 unit.

(4) Meditation training group. This group was required to participate in ten meditation training sessions of 30 minutes duration. During the training session, subjects listened to and followed instructions on a cassette tape with instructions for a meditation technique. This technique used a combination of breathing exercises and T.M.-type mantra.

(5) Progressive muscle relaxation training group. This group was required to participate in ten PMR training sessions of 30 minutes duration. During the sessions, subjects listened to and followed instructions on a cassette tape with instructions for a PMR training technique. The tape was entitled, "Relaxation Procedures, Tape T3, side I" and was prepared by Alan J. Rappaport, Ph.D.

The subjects in all four "training" groups (placebo control, EMG BFT, meditation, and PMR) were instructed that the relaxation training method for their group was effective in producing relaxation. All subjects attended two 30-minute training sessions per day for five consecutive days.

RESULTS

An analysis of variance with stratification on treatment which was run on the pretraining baseline data showed that there were no significant differences among any of the five groups on any of the dependent variables.

Muscle Tension. An ANOVA with repeated measures indicated that there was a significant interaction effect between pre and post test occasion and treatment. Pre-post ($F(\frac{1}{4})$=18.564 ms 5.22. $p<.05$) and Pre-post X Treatment ($F(4/49)$= 3.621 ms 1.018 $p<.05$). A modified Least Significant Difference (LSD) analysis indicated that only the EMG BFT ($F=25.53$) and meditation ($F=6.30$) training significantly reduced fro[illegible]alis muscle tension. A Mann Whitney U-test showed no significant difference between the EMG BFT and meditation groups with respect to percent reduction of muscle tenions (U/U' = 41/79, U/U' critical = 34/87, N = 11/11.

Electrodermal Response. An ANOVA with repeated measures indicated that there was no significant main or interaction effects. Pre-Post ($F(\frac{1}{2})$ = .036 ms 1.236, $p>.05$) and Pre-Post x Treatment ($F(4/49)$ = 1.112 ms 38.124, $p>.05$).

Heart Rate. An ANOVA with repeated measures indicated that there was no significant main or interaction effects. Pre-Post ($F(\frac{1}{4})$ = 1.815 ms 11.583. $p>.05$) and Pre-Post x Treatment ($F(4/49)$ = .553 ms 3.528, $p>.05$).

Skin Temperature. An ANOVA with repeated measures indicated that there was no significant main or interaction effects. Pre-Post ($F(\frac{1}{4})$ = 2.159 ms 49.893, $p>.05$) and Pre-Post x Treatment ($F(4/49)$ = 2.063 ms 47.694, $p>.05$).

Respiration Rate. An ANOVA with repeated measures indicated that while there was no significant interaction effect between treatment and pre-post test occasion and no significant main effect for treatment, there was a significant main effect for pre-post training test occasion. Pre-Post ($F(\frac{1}{2})$ = 10.96 ms 11.727,$p<.05$) and Pre-Post x Treatment ($F4/49$) = 1.723 ms 1.844,$p>.05$). The modified LSD analysis indicated that only meditation ($F = 4.86$) and PMR ($F = 10.96$) training significantly reduced respiration rate. A Mann Whitney U-test showed no significant difference between the meditation and PMR groups with respect to the percent reduction of respiration rate that were observed (U/U' - 51/59, U/U' critical - 22/88, N = 10/11).

DISCUSSION

The results of this investigation have shown that brief training in frontalis EMG biofeedback, meditation, and progressive muscle relaxation were more effective than the placebo control treatment in reducing some physiological parameters, but not others.

Comparison of the techniques utilized with the present study revealed a pattern of specific rather than generalized effect. EMG BFT was shown to be an effective method of relaxation training as measured by reduction in frontalis muscle tension. All subjects in the EMG BFT group learned to reduce their muscle tension irrespective of the level of the pretraining baseline; however, this change was only significant for those subjects who were above the average for the gorup on the pretraining baseline. Individuals who had low muscle tension levels at pretraining did not significantly reduce muscle tension following training (comparison by t-test).

EMG BFT did not significantly reduce autonomic nervous system

(ANS) activity as measured by EDR, Heart rate, respiration rate and skin temperature. It had been hypothosized that reductions in muscle tension would reduce ANS activity, which would in turn reduce the tone of the ergotropic system. This reduction of ergotropic tone would then shift the balance toward the trophotropic system, increasing tone. However, even though muscle tension was reduced, the ANS response did not occur with this technique.

The combination autogenic progressive muscle relaxation training technique was found to have no influence on muscle tension, EDR, heart rate, or skin temperature. Only respiration rate was effected by the training. The tapes utilized concentrate heavily on breathing technique, and it seems that a conditioning of that parameter did occur.

The meditation technique utilized in the present study resulted in significant reduction in muscle tension and respiration rate. There wes no significant change in EDR, heart rate or skin temperature. Previous studies of the physiology of meditation have indicated that there are reductions in heart rate, respiration rate, and skin conductance in experienced meditators during meditation (Wallace and Benson, 1972; and Walrath and Hamilton, 1975), and more recently Warrenburg, et al., (1977) found a decrease in muscle tension along with decreases in oxygen consumption and heart rate in experienced meditators. The subjects in the present study were novices in meditation with respect to experience (300 minutes). The exact effect of experience has not been well established, but one would intuitively expect a greater conditioning effect to occur with additional training. The reduction of muscle tension observed in the novice meditators suggested that the internal quietness allowed the meditators to become aware of feelings of tension and subsequently learn control over them or more probably the state of quietness indicated by decreases in muscle tension was learned and conditioned. The decrease in respiration again shows a specific conditioning process as the type of meditation used focused on breathing technique.

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Relaxation Techniques and the Relaxation Response

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With the establishment of a new branch of medicine namely "Behavioral Medicine", there has been considerable research interest in the possibility of instructing an individual in mind body consciousness so that the individual can direct the healing process from within. While there is considerable evidence to support the belief that the autonomic nervous system is subject to voluntary control, and can be directed to correct physiological malfunctions by our conscious brain, there are many questions that we still need answers to before we can judge its effectiveness as a form of primary prevention.

In this presentation I will attempt to address some of the major questions faced by researchers investigating the use of deep muscle relaxation techniques for mind body awareness in an educational model. At present there are no controlled studies of which I am aware that support or refute the inclusion of deep muscle relaxation training techniques (i.e., meditation, yoga, progressive relaxation, biofeedback, autogenics) in an educational model focused on primary prevention. However, it does seem to follow that if an increase in mind body awareness can be used to correct existing pathologies (i.e., hypertension, pathologic vasoconstriction, migraine headache, muscle tension headache, epilepsy), then perhaps this same mind body awareness can be used to both prevent disease and move to a higher level of functioning or integration (High Level Wellness). Even if mind body awareness can't serve as a prophylaxis against all disease, there is sufficient evidence to support the notion that achieving a state of deep relaxation is one way in which the organism can break the stress spiral. Dr. Green of the Menninger Foundation suggests that during periods of deep relaxation there is an information exchange within the body which initiates a more stable psychophysiological condition. Research in meditation has demonstrated that this stabilization of the psychophysiological state yields the individual more responsive to environmental interactions.

Enough has been said about the justification of research in mind body awareness. Now I shall focus on the relevant issues raised by Dr. Fee's study. Because of the widespread growth of individuals participating in various relaxation training procedures, a study was needed which examined the efficacy of the more popular relaxation techniques. Dr. Fee's study was an attempt to identify the degree to which various relaxation techniques induce the "Relaxation Response". The "Relaxation Response" as coined by Benson represents a constellation of physiological changes that occur within the body of an individual experiencing deep muscle relaxation. These physiological changes served as the criteria by which Dr. Fee judged the various relaxation techniques. His findings seem to indicate that while all the techniques examined did demonstrate a potential for inducing the relaxation

response, none of them was able to modify all the physiological parameters identified as the "Relaxation Response". Perhaps what is most confusing is the fact that of the three techniques examined, none were able to demonstrate the occurrence of the relaxation response on more than two parameters, even though all have been claimed to be effications for general relaxation.

Dr. Fee's findings raise a critical issue with regard to relaxation techniques in general and that is to what extent is the relaxation generalized throughout the body. To get a better handle on the issue it would serve us well to look at each technique and its theory both separately and collectively. This will provide us with a basis on which to make some sense out of the data. At present there are two major schools of thought with regard to mind body interactions. One school spearheaded by Jacobson (Peripheral) suggested that if one would relax the body, the mind would naturally quiet. The key to this technique is learning to relax a sufficient number of muscles concurrently which alters the general tonus of the musculoskeletal system. Based on this theory one would expect changes to be observed in the musculoskeletal system if in no other system. However, Dr. Fee found the only change to be in respiration rate. I agree with Dr. Fee's conclusion that the taped instructions for progressive relaxation were inadequate in the situation in which they were used. While Jacobson provided substantial data to support his theory and technique, his training program was much more extensive and taught over a much longer period of time. Perhaps Dr. Fee's findings with regard to progressive muscle relaxation are just a reiteration of the fact that this technique is not conducive to a rapid training procedure.

The other major school of thought regarding mind body interactions involves practitioners of meditation. The theory on which meditation is based suggests that if you quiet the mind, the other organ systems will adjust to a more stable condition. The key to this technique lies in the ability of the individual to direct his consciousness in such a way as to terminate internal dialogue (ego involving thoughts). In studies conducted by both Benson and Wallace, profound physiological changes were observed during the practice of meditation. The term "Relaxation Response" evolved from the observations Benson made while examining the physiological response to meditation. Because the "Relaxation Response" served as the criterion measure for evaluating these techniques, one would expect that meditation would satisfy the criterion measure. However, Dr. Fee only found changes in two of the six parameters measured. Those being muscle tension and respiration rate. Dr. Fee suggests that the results obtained may be a function of time and the meditation instruction which had the subjects focus on their breathing. I do not believe that these findings refute those of Benson but suggest that even with a simple technique like meditation a certain degree of the skill (ability to terminate internal dialogue) is necessary before there is a sufficient quieting of the mind capable of altering the other organ systems. This study also suggests that there may be an order or hierarchy in which various organ systems respond to this quieting of the mind.

Recently another school of thought has evolved. This group consists of biofeedback practitioners. The theoretical basis for

biofeedback lies in an integration of the previous two. This group believes that brain has the potential for voluntary control over all the systems it monitors, and is affected by all the systems it monitors. It is this intimacy of interaction between the psyche and soma that has provided the mechanisms through which an individual can learn voluntary control over biological activity. Biofeedback research has demonstrated the efficacy of using EMG biofeedback training to modify the neuromuscular activity within specific muscle groups, but the question as to the generalizability of this response to other muscle groups and organ systems has not been systematically tested. Presently there is some clinical evidence to support the use of EMG biofeedback training for the treatment of hypertension. This type of evidence suggests a link between activity in one organ system and another mediated by the nervous system.

The issue of specificity vs. generalizability is again raised by Dr. Fee's study in which he found that EMG biofeedback training only affected one parameter, that being muscle tension. I agree with Dr. Fee's conclusion that time may have been the limiting factor regarding generalizability of training effects. I would further suggest the following theory to suggest an explanation of the apparent paradoxical training effects noted with EMG biofeedback training. Within the musculoskeletal system lie key muscle groups which set the general tonus of the system. The tonus of these muscles may be voluntarily regulated by one's consciousness. A decrease in the general tonus of these key muscles to a threshold level will elicit a generalization of that lower tonus throughout the musculoskeletal system. This change in the tonus of the musculoskeletal system then triggers adaptive responses in other organ systems including the nervous system.

While the various approaches to relaxation differ in their theoretical base and method of instruction, there is one concept that lies central to all these relaxation techniques. That concept has been termed "Passive Volition". Because the term "Passive Volition" is descriptive of a state of consciousness, it yields little information regarding that state of consciousness. I believe that "Passive Volition" is best described as a state of consciousness in which the neocortex switches from an analytical mode to a more sensory or experiential mode of functioning. The significance of this state of consciousness is that this is the state in which the autonomic nervous system and other autonomic responses can be brought under conscious control. The key to attaining this state of consciousness is the ability of the individual to direct the conscious mind to attend to more sensory and less analytical activity. Because "Passive Volition" is in reality an altered state of consciousness, everyone has the potential to reach this state if provided the appropriate technique of instruction and a sufficient amount of practice.

While Dr. Fee's study did not answer many questions, it did help to clarify which questions need to be asked regarding the various relaxation techniques. Two additional questions also merit investigation. First, if relaxation techniques do indeed prove to be effective in the prevention of disease states, will they all be equally so? Second, given technique effectiveness, how much practice will be necessary to attain and maintain "Passive Volition"?

Selected Psychometric Properties of the Organ Specificity Score as a Component of a Stress Profile

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For over 3 decades researchers have been concerned with the role that psychophysiological stressor reactions may play in the etiology of numerous psychosomatic diseases. The phenomenon of "individual response specificity" (IR) may be an important aspect of that relationship. IR refers to the tendency of an individual to emit characteristically similar forms of psychophysiological reactivity to a variety of stressful stimuli. In effect, the presence of a rigid response "set" for autonomic reactions to stressors is implied for the individual who possesses this property of psychophysiological responding (Sternbach, 1966). Earlier researchers have advanced the hypothesis that the IR phenomenon may be the precursor of psychosomatic illness. Sternbach (1966) has suggested that such a finding could itself be a significant contribution to the primary prevention of psychosomatic disease.

To this point, however, research devoted to the IR phenomenon has not only failed to prove that it is the etiological link between stress and psychosomatic illness, but has similarly failed to demonstrate the stability of certain measurement properties of interest in this area of research. The problem in generating meaningful data appears to lie in the measurement procedure previously used. Historically, IR has been measured by utilizing the magnitude of autonomic arousal, over the prestressor level of activity, in response to the administration of a stressor. Initial research with this criterion conducted by Lacey and Lacey (1958) lead to the conclusion that such measurements were affected by the "law of initial value" (LIV). This proposition states that a stress arousal will be negatively correlated with the prestressor level of autonomic activity. However, later research conducted on the IR phenomenon failed to verify this relationship as existing with regards to the magnitude criterion. The importance of this issue resides in the fact that unless the IR criterion is unaffected by the LIV, controversial mathematical conversions must be made to allow IR comparability across individuals demonstrating dissimilar prestressor activity levels. A second measurement variable of concern was the test-retest reliability of the IR criterion. The Lacey's found the magnitude criterion for IR reliable on an immediate test-retest analysis. Conflicting results were obtained by other IR researchers whose data were clearly unable to demonstrate the test-retest reliability of that criterion over a 7 day

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interval.

These inconsistencies in the magnitude criterion used in determining IR have cast serious doubts upon the utility of the majority of this data. With this in mind, Everly (1978) formulated an alternative measurement criterion for the IR phenomenon, called the Organ Specificity Score (OSS). The OSS utilizes the elapsed time required for a given autonomic response system to return to its prestressor activity level following the administration of a stressor. The utilization of of this recovery time criterion was based upon the early pioneering research in abnormal psychology and pathophysiology which demonstrated its utility in the measurement of symptom specificity, a forerunner of the IR construct. An individual OSS is generated for each of the autonomic response systems being measured. These individual scores are then combined into a total profile called the Stress Specificity Profile.

PURPOSE OF THE STUDY

In an attempt to make a contribution to the primary prevention of psychosomatic disease, this study was conducted to evaluate selected psychometric characteristics of the OSS as proposed by Everly (1978). Under specific consideration were:

1. the effect of the LIV upon the recovery criterion;
2. the test-retest reliability of the OSS over a 7 day interval.

METHOD

Subjects

The subject population in this study consisted of volunteers from the student body at the University of Maryland, College Park, during the Fall 1977 term. A total of 48 subjects were selected from the subject pool, 22 males and 26 females. The mean age for the subject population was 24.54 years, with a S.D. of 3.22 years. All subjects were free from active symptomology of any disease or illness.

Procedure

The laboratory techniques used in this study were based upon the laboratory protocol developed by John Lacey (see Lacey and Lacey, 1958).

Subjects were asked to report to the Psychophysiology Laboratory in the Department of Health Education on the College Park campus for testing. The testing room was maintained at 74 degrees F with a relative humidity of 50%.

Subjects were seated as their blood pressures were taken as a screening procedure. Pressures in excess of 150 / 90 mm/Hg were considered excessively high for the purposes of this study. Those individuals were eliminated from the subject pool.

Each subject was connected to 5 physiological recording devices which monitored the subject's autonomic reactivity during the administration of 2 stressors and the respective recovery times.

Heart rate (HR) and respiration rate (RR) were measured by use of an IMI Infralarm (model 66000) which was linked to the subject by 2 Beckman Ag/AgCl 15 mm electrodes placed bilaterally on the lateral most aspect of the of the 9th rib. The IMI system was recorded utilizing a Beckman Dynograph Type R analog recorder for continuous recording.

Galvanic skin resistance (GSR) was measured from palmar surfaces of the 2nd and 3rd fingers of the left hand using 2 Beckman electrodes as described above and the Coulbourn Instruments (CI) Skin Resistance program. The data from this system was fed into the CI digital recorder which printed cumulative readings every 6 seconds.

Muscle tension (EMG) was measured electromyographically from the frontalis group using the CI EMG program and Beckman electrodes. The EMG activity was recorded in the same manner as was the GSR data.

Digital skin temperature was monitored from the palmar surface of the index finger of the left hand. A thermister connected to the CI temperature program was utilized. This data was recorded cumulatively and printed every 6 seconds from the CI digital printer.

After allowing the autonomic activity of the subject to stabilize for at least 10 minutes, the prestressor autonomic levels were recorded for at least 3 minutes. Following this baseline period, the first of 2 stressors was administered in the form of a cold pressor consisting of ice water maintained at 4-5 degrees C. The subject's right hand was placed into the water up to the wrist for 30 seconds. The 5 autonomic parameters were continually measured while the subject's arousal level returned to baseline. The recovery to baseline was defined as the point at which respective systems returned to the prestrssor levels of activity and remained there for at least 30 seconds. Once it was seen that the recovery criterion had been met, the beginning of that 30 second criterion, only, was used as the demarcation line to end recovery.

After all of the response systems had recovered, the second of the stressors was introduced in the form of a 93 dB horn blast lasting for .7 seconds. The same measuring and recording processes were used. Upon recovery of the last response system, the experimental session ended.

At the same time of day one week later, the entire experimental process was repeated as a retest. This time the order of stressor presentation was reversed, however. Thiswas a test of reliability for the OSS.

Organ Specificity Score

The OSS treats each autonomic response system individually by generating a separate OSS for each autonomic response system being monitored. The compilation of these scores is referred to as the Stress Specificity Profile.

The creation of the OSS involves utilizing the recovery times from the 2 stressors within a single ex-

perimental session. The formula for generating the OSS may be expressed:

$$OSS = \left(\frac{T_1 + T_2}{2}\right)\left(\frac{T_{lowest}}{T_{highest}}\right)$$

T_1 = T score for recovery time from stressor 1
T_2 = T score for recovery time from stressor 2

T_{lowest} = the smaller of the T scores
$T_{highest}$ = the larger of the T scores

RESULTS

No review of the previously conducted research in the literature presented sufficient evidence to eliminate the need for stratification or statistical blocking of the data generated from this sample. Therefore, all subjects were pooled for analysis.

Table 1 - Descriptive Statistics for Raw Score Recovery Times in Seconds (N=47)

Response System	Cold Pressor Mean	Cold Pressor S.D.	Horn Mean	Horn S.D.
HR	166.17	72.53	188.78	62.91
RR	229.72	83.14	202.70	67.15
EMG	45.00	15.02	34.89	11.23
GSR	16.74	5.70	23.49	9.28
TEMP	406.34	130.70	352.91	116.29

Table 1 shows the raw times in seconds that were required for the sample population to recover to a baseline level given the 2 stressors and the 5 measured response systems.

To investigate the relationship between the LIV and the OSS, a Pearson product-moment correlational analysis was performed. In this analysis, the prestressor levels of autonomic activity were correlated with the raw time in seconds needed for recovery. This was done rather than using the prestressor level with the OSS because the analysis was performed to test a psychophysiological phenomenon, not the effects of a mathematical manipulation. Table 2 reports these findings.

Table 2 - Pearson Product-moment Coefficients Between Prestressor Levels and Recovery Times (N=47)

Response System	Cold Pressor	Horn
HR	.073	-.174
RR	-.118	.189
EMG	.220	-.194
GSR	.380**	.330*
TEMP	-.015	-.016

df = 46 **p<.01 *p<.05

A product-moment correlation was performed between the OSS data generated during the first testing day and the OSS data generated during the second testing, 7 days later. Table 3 reports those results.

Table 3 - Test-retest Reliability Coefficients For OSS

Response System	Product-moment Coefficient
HR	.850**
RR	.698**
EMG	.916**
GSR	.883**
TEMP	.168

df = 46 **p<.01

The results in Table 2 suggest that the recovery time criterion was not affected by the LIV for the HR, RR, EMG, and TEMP parameters to any significant degree. The LIV did appear to affect the GSR recovery, however.

Table 3 reports data demonstrating 7 day reliability for the OSS as applied to the HR, RR, EMG, and GSR parameters for these subjects. TEMP was not reliable over that same interval.

DISCUSSION

The purpose of this study was to report on two measurement variables as they affected the OSS procedure for measuring IR in 22 male and 26 female college students.

For the present population, the LIV clearly affected the creation of an OSS for GSR. No other parameters were as significantly affected.

Based upon this study, it may be suggested that the OSS is stable over 7 days for the measurement of HR, RR, EMG (frontalis), and GSR.

Based upon these findings, future research may wish to further explore the LIV in relation to recovery time. Presently, GSR appears to require a correction factor to allow comparability across subjects with dissimilar baselines. Benjamin (1963) reviews such corrections. The instability of the OSS for TEMP may be due to lack of sufficient stabilization time allotted on the second day which was colder than the first.

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What Research Says About Safety and Facilities For Girls and Women in Sports

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Planners and designers of buildings have become increasingly aware that they are not merely reshaping space, but are also influencing and limiting the activity that will occur in that space. As one writer has put it, "...there is no such thing as the design of space or spaces: behavior, not space, is enclosed by architecture." (2)

Athletic facilities are specialized buildings for specialized activities. They need careful assessment regarding the manner in which they influence behavior and more particularly in regard to safety. Almost half the liability suits in education and recreation are a result of negligence in planning or supervising athletic facilities. (5)

The past decade has seen a dramatic growth in use of athletic facilities by both men and women, especially by women. To determine when and where women are most frequently injured in collegiate athletics a study was conducted recently in 361 schools. Inadequate facilities ranked as the second most frequent contributor to injuries. (4)

Despite these indications of the importance of facilities in sports safety, there has been little coordinated effort directed at investigating the components of the physical environment which contribute to health and safety problems.

In the planning of any facility there are some general considerations that can have an immense effect on safety, such as the placement and proximity of activities, traffic patterns, ingress and egress, floor surfaces, visual cues, security of high hazard equipment (e.g. trampolines), and adequate supervision of physical activities.

There are safety considerations that need special attention. Swimming pools, diving wells, and shower rooms present specific hazards in floor surfaces as do toweling and dressing areas. Recent recommendations of synthetic carpeting for these latter areas may prove to be a solution. (1)

There has been an increase in use of athletic facilities by women. Title IX specifies the provision of equal equipment and facilities. Growth in numbers of participants has resulted in record high use of athletic facilities and crowding that has safety implications for women and men. Research designating crowding as a high contributor to athletic accidents is rare, but there are factors in crowding that amplify the risks of injury.

There are three elements of safety and health in buildings which are commonly overlooked in research and in practice. They are the visual, sonic, and thermal environments. Each of these elements can have a profound, although sometimes subtle, influence on the safety and health of persons who regularly occupy a building.

The visual environment can be influential in a number of ways which are related to physical movement and activity. The amount of illumination is, of course, essential to any visual task, especially those involving the movement of persons and objects. Less well appreciated are other qualities of light such as color temperature, contrasts in the visual field, and reflectance. These qualities can actually worsen with increases in illumination.

Gymnasia are especially troublesome environments. They contain ceiling light contrasts ranging as high as 350 to 1, making it difficult to see a ball in the air. Walls and floors often have far too low visual field contrasts (e.g., 1:1). Specularity of gym floors is another common problem.

Color surrounds affect physiologic functions such as blood pressure, respiration, pulse, and eye blinks. Recent studies (7) have pinpointed this effect to hue or how mellow is the color.

In similar fashion, the sonic and thermal environments are composed of a set of factors rather than a single one. These are also critical factors in athletics. Noise levels of a serious nature are accepted as part of spectator sports, if not outright encouraged as essential to the conduct of those sports.

Because the effects of these factors on the health of participants are not sudden and dramatic, they tend to be discounted. Yet, they will gradually take their toll. It is this insidious nature of these factors which has made it difficult for people who design and manage athletic facilities to take them seriously.

The accumulation of information on environmental variables in accidents requires an effective accident data system. Damron outlines the need for effective accident data systems in light of the growing numbers of participants in all sports (3). Without effective reporting systems the problems inherent to athletics cannot be adequately solved.

Two questions rather than one have been raised. Do existing athletic facilities reflect the interests and abilities of females? Are such facilities more hazardous to females than to males? The answer to the first question will become clear as those interests and abilities become more clear. The answer to the second question is "not intrinsically so."

There is very little evidence pointing to differences in facility needs between men and women. One factor is heat stress. Working under given thermal conditions, women's heart rates are faster than men's (6). Women perspire less readily than men and subsequently have lower evaporative heat losses (8). The amount of heat stress exerted by the environment can be assessed by measuring the relative humidity and the evaporation of body heat lessens as relative humidity rises. Closely monitored ventilation and humidity control systems would ensure more supportive indoor environments for women in sports.

While relative humidity may not be a critical factor in athletic performance, it is a factor and represents a controllable environmental variable.

What does research tell us about safety and facilities for girls and women in sports? Much research has been done on single elements, such as the eye or light intensity standards, but little on the interaction of elements. Yet, we know enough to be wiser than we have been about the design and use of athletic facilities.

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Breast Support and Protection in the Female Athlete

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Proper protective equipment for the female athlete has too long been neglected. With the advent of Title IX and the precipitous increase in participation in all types and variety of sports by female athletes, the need for proper sports equipment and clothing has become very apparent. For too long the idea that any special type of protection was necessary for the breast, except in such sports as fencing, has been overlooked.

Initial studies done in 1975 and 1976 seemed to indicate that there were no injuries to the breast and therefore that no other protection was needed.[1,2] Discomfort to the point of disabling the female athlete has occurred and has now been documented.[3] Before going into specifics regarding proper breast support, the anatomy of the female breast should be reviewed.

The female breast has one primary function, the production of milk to support the growing infant. Society has attached to the female breast various sexual connatations as to size and attractiveness, and caused in many cases severe psycological problems when breast surgery is necessary, or the breasts are unusually small.

Anatomically the breasts are two glandular structures lying over the pectoralis major muscles on the anterior chest wall. Their support is entirely dependent on the skin, subcutaneous tissue, and some rather flimsy fascial planes referred to as Cooper's "ligaments". In reality these are not ligaments in the same sense that we have ligaments that attach muscles to bone or support joints. These fascial planes are intended primarily to divide the glandular elements in the breasts into lobules from which ducts drain to the nipple during lactation.

One need only to look at pictures from any primative area of the world to see that universally by middle age, all females in those regions where supporting breast garments are not worn, have flattened, pendulous breasts, the length they hang being dependent on the original size of the breasts. Only women with very small breasts from birth retain these structures in position on the upper chest.

It is true that with advancing age most women's breasts flatten and elongate, but this happens much later in civilized areas where some supporting garment is worn, and it is primarily due to loss of turgor and adipose tissue with the decline of female hormonal levels that stumulate breast tissue.

I do not intend to imply that women who exercise without bras will all end up with unsightly breasts, especially since these women will normally wear a bra on other occasions, but I do not advocate such a practice.

During part of the menstrual cycle most women experience some discomfort in their breasts based on hormonal stimulation. This is generally most pronounced just prior to the onset of the menstrual flow. A good supporting bra has been advised for years along with a mild analgesic for relief of discomfort, and usually it is efficatious. Many women will wear the brassiere to bed during this part of their menstrual cycle.

It is certainly not unreasonable then to assume that the woman athlete will suffer even more discomfort when she participates in her sport during this time of the month.

A second survey conducted by Ms. Joan Gillette and myself in 1977 showed that from 115 responders, 31% reported some type of breast discomfort during sports activity. Of the positive responses, 52% were due to specific injuries and 48% were due to discomfort. A total of 72% overall reported breast tenderness following sports activity.[3]

The injuries reported are indeed minor. These included contusions, abraisions, hematomas, and a rare laceration. Secondary problems were due to hematomas that required evacuation, or drainage of breast abscesses resulting from infected, neglected abraisions.

Even minor problems in this very sensitive part of the female anatomy can, however, prove disabling. Can you imagine a right handed tennis star being able to perform with any great skill with a painful right breast? Or a softball pitcher? Or for that matter any sport in which a lot of motion of the right arm requiring the use of the pectoralis muscle is required?

Another question that can be posed is how many coaches or trainers have seen large breasted women who are top competitive runners? There may be exceptions,

but they are few and far between. Large breasts are a definite impediment to running, especially the longer distances.

In fact, large breasts pose a problem in almost all sports. These women definately require a good supporting bra! Women who compete in collision sports (football, ice hockey, soccer, fencing, or boxing) in addition may require some degree of padding in the garment.

In general any good sports bra must meet the following criteria.

1. Provide good upward support.

2. Limit motion of the breast relative to the body.

3. Be made of material that is absorptive, non-allergenic, non-abraisive, and mostly non-elastic.

4. All fasteners should be well covered on both sides to prevent abraision to the skin or to other players.

5. The straps should be wide, non-elastic, and so designed that they do not slip off the shoulders.

6. Some provision should be made at the base of the bra to prevent "riding up" of the bra over the breast by either a wide cloth band below the breast, or a non metal "underwire".

7. A pocket inside the bra should be provided to enable the placement of padding when indicated.

Needless to say, no such true sports bra exists at the present time, although several manufacturers are supposedly working on it.

A film showing the motion of the breasts during walking, running and jumping was made with the assistance of Dr. Gail Sheirman of the University of Oklahoma and graphically visualizes the range of movement of the breasts.

It clearly shows the forces involved as the unsupported breast rises and slaps down on the chest wall. The investigators are at present conducting additional

studies to measure these gravatational forces in foot-pounds, and the early figures are impressive.

One "old wives' tale" concerning the possible relation of a blow to the breast to cancer must be laid to rest. There is NO such cause and effect documented or known.

Certainly just as with all females, women athletes should be aware of the importance of self examination of the breast and the need to report all found lumps to their physician, but the consequences of possible injury to the breast should never be a deterrent to participation in any sport so long as a good supporting garment is worn when indicated.

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Running Tests For 7-9 Year-Old Children

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INTRODUCTION

In 1975 AAHPER published a revised edition of the Youth Fitness Test Manual (1). For several years before that publication, exercise physiologists, physical fitness experts, and tests & measurements specialists had recommended the inclusion of a distance run test in the AAHPER Battery to measure aerobic power. It was generally recognized that the six-hundred-yard run/walk test was too brief to adequately measure aerobic power. In 1975 the revised edition contained distance run options for children.

There is considerable support for the rationale of using a distance run test as a field measure of aerobic power. Balke (3) was one of the pioneers in developing a fifteen-minute run/walk test which was scored in meters per minute. Cooper (5) later refined and popularized the twelve-minute or 1.5 mile run/walk test. Studies done with adolescent and adult populations have generally yielded the result that an increased correlation is found relative to treadmill measures of aerobic power by increasing the distance of the run test. This is particularly true as distance tests are increased from several hundred yards to over a half-mile or mile (6).

In reviewing work done with elementary school children the picture is not as clear, that by progressively increasing the distance run the correlation with laboratory measures of aerobic power will progressively increase. Jackson and Coleman (8) reported significant correlations for nine-minute and twelve-minute runs with aerobic power, using elementary school children. The twelve-minute run proved, however, to be no more valid than nine minutes in predicting aerobic power. For fourth- through sixth-grade children, the correlations range from r= -.71 to -.82.

Gutin and his co-workers (10) have studied the effects of physical training on the cardiovascular fitness of children. They found a higher correlation between running and aerobic power at 1200 yards (.68 mile) than at 600 yards or 1800 yards (1.0+ miles). Correlations ranged from r= -.71 to -.81 for the ten- through twelve-year-old children.

Krahenbuhl and his co-workers (11) found higher correlations at 1.0 mile for eight-year-olds than at 600 yards or 0.75 mile. The correlations between 1.0 mile run and $\dot{V}O_2$ max were r= -.26 for girls, and -.71 for boys. Also of note,

they found correlations of r= .77 (girls) and .85 (boys) between $\dot{V}O_2$ max and performance on the Bruce Treadmill protocol (4). In a follow-up study of first- through third-graders, they found higher correlations at 1600 meters (1.0 mile) for children who evidenced a plateau in $\dot{V}O_2$ (12). For those children, they reported a correlation of r= -.60 for boys and -.74 for girls between 1600 meters run time and the $\dot{V}O_2$ max.

METHODS & RESULTS

Twenty-seven girls and thirty-eight boys (n=65) ages 7 to 9 were given a maximum treadmill test using the Bruce protocol (4). Performance time on the treadmill was compared with running performance at 600 and 880 yards, and 0.75 mile and 1.0 mile. The children were from the Riverside School District and all of the tests were administered within a two-week period. The tests were administered late in the spring after a yearlong physical fitness program and considerable practice at running various distances.

Human experimentation consent forms were obtained from parents and the children were monitored for heart rate during the treadmill test. The instructions were standardized and read to the children. The average maximum HR attained during the treadmill test was 193 for girls and 203 for boys.

The major interest of this paper is the relationship between maximal treadmill performance and running performance for seven- to nine-year-old children at various distances from 600 yards to 1.0 mile. These relationships are depicted in Table 1. The relationship does not increase with increased distance, as might be expected. Although most of the correlations are significant, they are not very predictive of aerobic power and the correlations for seven- to nine-year-old girls are particularly low.

TABLE 1.

CORRELATIONS BETWEEN TREADMILL PERFORMANCE AND RUNNING AT VARIOUS DISTANCES (Ages 7-9)

	600 Yards	880 Yards	0.75 Mi.	1.0 Mi.
GIRLS	-.21	-.55	-.33*	-.26
BOYS	-.59*	-.45*	-.45*	-.33*
COMBINED	-.52* (N=64)	-.55* (N=27)	-.48* (N=65)	-.39* (N=65)

* Significantly different from zero at .05

DISCUSSION

A year before the current investigation was conducted, correlations had been obtained on maximal treadmill performance and the AAHPER 1.0 mile field test for ten- through twelve-year-old children. The results yielded r= -.75. Since there are no established distance run tests for children below the age of ten, a similar procedure was followed with a small group of seven- through nine-year-old children at the distance of 600 yards. The results yielded a r= -.52, which prompted the use of a larger number of children at a variety of distances from 600 yards to 1.0 mile.

The correlations reported here are somewhat lower than those reported by others. There are some similarities, however, in the data that give rise to some speculation regarding the use of distance run tests for younger children (ages 7 to 9). It might be profitable to review some of those concerns.

A major factor in the testing of children is motivation. Godfrey (9) maintains that a HR of 195 usually insures a maximum effort on the part of children ages 5-15 years, and that the maximum HR for children varies little with age. On that basis, there is good reason to suspect the maximum effort on the treadmill test from the children at Riverside. A high relationship between performance on the Bruce Test and $\dot{V}O_2$ max also supports the treadmill test as a reasonable measure of aerobic power. The low correlations reported for the younger girls have also been noted by others and we would strongly suspect a motivational factor.

This data when viewed in combination with other data gives the hint of a possible U-shaped curve with a "most valid" distance run falling somewhere between 600 yards and 1.0 mile for seven- to nine-year-old children. You may recall that Jackson and Coleman (8) found no greater correlation at twelve minutes than at nine minutes, and that Gutin (10) found a higher correlation at .68 miles than at 600 or 1800 yards. It should be noted, however, that those studies were done with older children (ages 10 through 12). Although Krahenbuhl found a higher correlation at 1.0 mile with $\dot{V}O_2$ max, he selected only those subjects who plateaued on $\dot{V}O_2$, thus eliminating those with motivational problems and perhaps increasing the magnitude of the correlation.

The conclusion to be drawn by this observer is that in the absence of standardized running tests for primary aged children, widespread testing and validation study would be appropriate at this time. Alternative modes of testing might also be explored, although the major consideration for the profession is the development of field tests which can be readily handled by the practitioner. The development of cardiovascular fitness tests and national norms for primary aged children would certainly appear to be a worthy objective for the profession.

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Treating the Obese Child in the Public School Setting

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The purpose of this paper is to offer a systematic approach for dealing with children who are obese. A large number of problems occuring with children in physical education are caused by obesity or obesity related syndroms, it is important to deal with the problem in a fashion that assures the best possible opportunity for success.

This approach deals with increasing the child's amount of physical activity. The program offers a quality program for a few individuals which is administered by the physical education specialist in the elementary school setting. In most cases, the amount of time the specialist can realistically devote to low fitness instruction is limited and thus the reason for a limited number of candidates. Youngsters are selected on the basis of their opportunity for success. In too many cases, teachers select those youngsters who are the most obese, have the least interest in activity, and have parents who do not want to involve themselves in the treatment process. The resulting failure leaves parents, teachers, and the obese child disappointed and with the belief that there is little hope for solving their problem.

This approach advocates gathering as much objective and subjective data as possible about the youngster under consideration, and then weighing the opportunity for successful treatment. Those youngsters who appear to have a lesser chance for success should not be forgotten and uncared for, but referred to more qualified personnel. Severe cases of obesity will probably only be successfully treated by a team of physicians, nutritionists and other qualified help who can spend a great deal of time with the individual.

Evaluation and Selection of Candidates

The following data will be collected to aid in making a meaningful appraisal of the candidate to see if the specialist can be of value to the youngster in reducing his level of body fat.

1. The following areas should be evaluated and data gathered for developing a "success profile" on each candidate.

   a. Height and Weight--the child should be accurately weighed and measured and the data recorded. Height and weight charts can be used to find the percentile ranking of the student in terms of physical growth. This data will also serve as a baseline for later comparison.

   b. Skinfold Measurement--Two skinfold measurements should be taken, one on the back of the arm halfway between the acromion and olecranon (triceps), and the second on the back underneath the angle of the scapula (sub-scapular). Both measurements should be made on the right hand side of the body for consistancy. For a complete description of the triceps and subscapular skinfold measurement techniques, refer to the study by Seltzer and Mayer (7). The measurements should then be changed to percent body fat using the data gathered by Parizkova (6). A cutoff point should then be decided upon as

a determination of obesity. Most experts recommend more than 20 percent as being obese (7).

c. Attitude Toward Physical Activity--The CATPA Attitude Inventory (8) should be administered to diagnose whether the student has a positive feeling about physical activity. A low score in comparison to other low-fit students may indicate that the youngster may be more difficult to treat due to his low interest in physical activity.

d. Self-Concept Measurement--The instrument employed by Pangrazi (5) using the Osgood's Semantic Differential technique (4), should be used to evaluate the student's physical self-concept. The physical self-concept measurement and attitude toward physical activity should be used later to evaluate whether the program is having any effect on the affective domain of the child.

e. Physical Fitness Evaluation--The following items should be administered to each candidate: (1) Bench push-ups, (2) Curl-ups, and (3) Squat jumps (1). Other test items could be substituted as long as they measure the major body parts and are sensitive to the small amount of improvement the obese child is likely to make. Due to the low-fitness level of the child, the 600 yard run-walk, rather than a longer distance, should be used to evaluate cardiovascular efficiency. This data will also serve as a baseline for comparison later in the program.

2. When all data has been collected on the low-fit candidates, selection should be made based on the following criteria:

a. The student is obese--more than 20-25% body fat.

b. Specialist's feeling about the student--one must genuinely want to help this student. If not, don't waste time and effort, but work with another student toward which there is a positive attitude. Hopefully, there will be a very limited number of students toward whom a negative feeling exists.

c. The classroom teacher's assessment of the student and his chance for success.

d. Any assessments from other school and/or health related personnel such as the nurse, doctor, counselor, and principal.

e. Scores on the fitness survey, the attitude inventory, and self-concept scale. This judgement will be a relative one in which all low-fit students are compared against one another. In other words, students who have scored highest on the three test instruments should be treated as they will probably have the best chance for success. The student who is a borderline obese individual will offer the specialist the best opportunity for success in the shortest amount of time and thus should be the first candidate selected.

3. Those students selected will not be considered probable candidates for the program. They will not be a part of the program until the conference with the parents has been carried out and found to be a beneficial and symbiotic relationship for student and teacher alike.

Conference with Parents and/or Guardian

Parents should be notified by telephone that their child is a probable candidate for special help in the low-fitness program. This should be done after the above evaluation so that the gathered data can be shared with parents. If possible, it is best to call all parents in for a single conference and discuss the program in a question and answer format. When parents meet in a small group

environment, they are usually more at ease in observing that other parents have children with similar problems. Also, a wide range of questions may be asked in a small group setting.

The essence of the meeting with the parents is to clarify and finalize the following points:

a. the objectives of the program
b. the operation and organization of the program
c. the data gathered--each parent should be given an individual profile of his/her youngster
d. the responsibilities of the obese student
e. the responsibilities of the parents
f. the need for and scheduling of follow-up conferences with parents.

Implementation of the Program--The Conferences and Notebook

After the youngsters have been selected for the program, a conference time for each youngster should be arranged. This time should be a regularly scheduled commitment so the youngster realizes that once a week he is required to meet with the physical education specialist. If humanly possible, this meeting should not be arranged during recess, lunchtime, before or after school, as it almost makes it a punishment to be in the low-fit program. Free-time is a commodity that students value more than any other thing in school and it should not be taken from them. The following are some guidelines that should be considered in the conference time.

1. The conference should last 15 to 30 minutes. During this time the student should not feel rushed, but rather as though you have time and concern for him. Personal problems, problems with the activity, reasons he is not following the program, etc. should be discussed.

2. During the conference, you should check his notebook and see if the student and parents have been carrying out their responsibilities. If time permits, it would be beneficial to have the student perform his assignment for the coming week in order to get a feeling about how the workload suits him. This will also give the youngster a chance to show-off if he has been exercising regularly and has made good improvement.

3. The conferences can be done with two or three students if they are compatible. This should be done only if it enhances the experience for the student, not if it is only more convenient for the teacher. The program deals with only a small number of students and there should be time for each individual. In some cases, working with another student will increase the enjoyment of the conference and activity for both students. Students should not compete with each other in the conference as, many times, one youngster will dominate and make the others feel insecure.

4. Testing of the child's fitness level should be done every third week so that all involved personnel can clearly see the progress (or lack of) being made. This will also give the specialist a good indication of whether the workload is being offered in the right amount. If little improvement occurs, increase the workload.

5. The notebook should be the property of the student. He should take it home each week and return it for the conference. In the notebook should be included the following:

a. description of the acitivites to be performed. They should be written so that both the parents and student can easily comprehend them.

b. physical fitness test record sheet
c. daily fitness card
d. weekly progress report
e. progress report to parents form

6. Before the child leaves the conference, make sure that he is clear about his new exercise assignment. This might mean demonstration, question and answer, or sending home a piece of equipment for his practice sessions.

Activity for the Low-Fit Student

In assigning activities for low-fit youngsters, the following guidelines might be considered:

1. As mentioned earlier, in most efforts at weight control, there have been three variables which have been manipulated. Diet, self-concept, and activity level. In terms of diet, this variable is difficult to control in our situation and has been found by many researchers not to be the crucial variable (2,3). Self-concept is important and should serve to remind the teacher that success experiences with the assigned activities should be arranged. The variable that can be manipulated successfully in an environment such as the school, is level of activity. Thus, most of the activity you assign should be aerobic in nature, and result in greater caloric expenditure. It should involve activity for a prescribed duration of time and cause the youngster to breathe more rapidly than he does at rest or relaxation. Strength is an important variable in learning motor skills, but usually does not demand a high expenditure of calories and in turn does little for the problem of obesity.

2. In assigning actual activities for the youngster, the following criteria may be helpful:

a. The activity assigned should not be in lieu of activity already performed by the student. It is important to have some idea of the amount and type of activity this student performs and then assign activities that will surpass his present level.

b. The weekly activity assignment should contain two or three choices so that the individual can fulfill his activity requirement in several ways. For example, the student might be assigned twenty minutes of activity per day and could fulfill this by biking, hiking, or playing basketball.

c. Activity assignments should be made in terms of minutes per day. A suggested starting point is ten minutes per day, increasing at a rate of two minutes per week to a maximum of 30 to 40 minutes per day. The important point to remember is that the specialist is attempting to change the lifestyle of the youngster from one of a sedentary nature to that of increased activity.

d. The following are some activities that can be used to increase the activity level of the student. They appear in an approximate order of difficulty and the teacher should select from the top of the list and proceed toward more difficult activities as the youngster's fitness level increases: (1) Walking, (2) Skateboarding, (3) Roller or Ice Skating, (4) Bike Riding, (5) Moto Cross Biking, (6) Hiking, (7) Sport Activities Unorganized, (8) Running in Place, (9) Orienteering, (10) Jogging, (11) Swimming, (12) Rope Jumping.

Follow-Up Activities

1. The parents should receive some type of communication every other week. This might be a note sent to the parents or better yet, a phone call or visit with the parents. This should be a progress

report and a discussion of the strengths and weak points in the treatment. The specialist cannot expect the parents to stay interested if communication with them does not occur on a regular basis.

2. Every other week the specialist should visit the classroom teacher of the low-fit youngster. This conference should be for the purpose of letting the teacher know the type of treatment being used, how the youngster is doing, and whether the classroom teacher could be of help. Again, since the classroom teacher spends more time with the youngster than anyone else, they can be of great help!

Summary

The approach offered here advocates changing the activity level of the obese youngster rather than altering diet or self-concept. Since the physical educator is qualified to offer and monitor activity programs, only those youngsters who show a propensity for success should be treated in the low-fit program. The selection process is based on both the objective data collected and professional judgement made by the physical educator. The program offers a quality program for a few youngsters rather than treating a large number superficially. Hopefully, through positive experiences with the specialist and an increased activity level, the youngster will alleviate the problem of excess fat for a lifetime.

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*A more complete discussion of this approach and/or extensive list of references is available on request.

Biometric Characteristics of Distance Run Tests

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The approach to physical fitness evaluation is evolving from the use of motor fitness tests such as the AAHPER Youth Fitness Battery (1976) to tests with an emphasis on health. The shift to health-related fitness reflects a philosophy of implementing programs designed to improve mortality and morbidity from disease, especially cardiovascular diseases which are prevelant to industralized societies.

Under medical supervision, many fitness centers, YMCA's, colleges and universities are starting scientifically devised fitness programs. Basic to such a program is the evaluation of aerobic working capacity by laboratory methods. Laboratory determined aerobic working capacity is not feasible for mass testing; thus, physical educators have focused their efforts on finding valid tests suitable for mass testing.

One of the more popular field tests is distance run performance. Presently, the states of Texas and South Carolina have batteries with test items of distances of one mile or longer and nine minutes or more in duration. The AAHPER battery (1976) includes as alternates to the 600 yard run, the test items and norms of the Texas Test.

The focus of this paper is on test-validity or the biometric qualities of distance run tests. The biometric characteristics will be examined from two positions: first, the general sources of variance common to tests of different distances; and second, the relationship between distance run tests and aerobic working capacity.

Construct Validity of Distance Run Tests

The statistical procedure called factor analysis allows one to identify the source of variance common to different tests. The isolated factors may be viewed as theoretical constructs which are mathematically defined by the resolved factor structure coefficients (i.e., factor loadings). The factor structure coefficients not only allow one to identify the theoretical constructs, but also isolate tests that validly measure the construct. Since distance run tests vary in either length or duration, factor analytic models are especially useful for isolating dimensions of running.

Disch (Disch, Jackson & Frankiewitcz 1975) examined the factor structure of distance run tests. Disch administered to 60 adult men two speed measures and eight distances run tests which included the 12 minute run and seven distances varying from

one-half mile to two miles in length. The analysis isolated two factors: one factor was represented by the speed measures and the one-half and three-quarter mile runs; and the second factor was represented by the 12 minute run and the distance runs which varied from one to two miles in length. Burke (1973) found the same factors using both laboratory and distance run tests.

A similar study (Jackson & Coleman 1976) was conducted with 17 different samples consisting of over 1600 boys and girls enrolled in Texas elementary schools. Each student was tested on the 50 yard dash and distance runs of 3, 6, 9 and 12 minutes in duration.

All 17 data sets were analyzed with alpha factor analysis and each analysis produced only one factor; however, a canonical factor analysis of the same data sets supported a two-factor solution. One canonical factor was represented by the dash, three minute run and to a lesser degree, the six minute run. The second canonical factor was represented by the 9 and 12 minute runs. The differences between the alpha and canonical solutions can be traced to the variables analyzed. The communality estimates of the 50 yard dash were low which showed that the 50 yard dash was not highly correlated with the distance run tests. Since alpha is a model based on common variance, more speed measures would need to be included to mark the speed factor. Canonical factors may be interpreted as tentative factors that would be found with alpha factor analysis if enough speed measures were included to mark the speed factor.

The factor analytic findings supported the use of the 9 and 12 minute tests with elementary school children. These findings provided the research base for the selection of the distance run tests of the Texas Test.

Concurrent Validity of Distance Run Tests

The factor analytic findings support the use of distance runs over one mile in length and 9 minutes in duration. Unanswered, however, is the concurrent validity of the common variance measured by this factor. This variance may be attributed to several different sources of variance such as body composition, aerobic endurance or motivation.

Max VO_2 expressed per unit of body weight has been the dependent variable used most often to validate distance run tests. Summarized in the Disch study (Disch, Jackson & Frankiewicz 1976, p. 174) are correlations reported by other investigators between running performance and Max VO_2. The running tests ranged in length from 100 yards to three miles or 12 minutes in duration. Of the 10 correlations reported for runs of less than one mile, only three were significantly different from zero. In contrast, 18 of the 20 correlations reported for runs of one mile or longer and 9 and 12 minutes in duration were significantly different from zero. The samples used for these analysis varied in both age and sex, however, noticable differences in covariation trends could not be traced to differences in sex or age.

The concurrent validity studies showed that longer distance

runs are related to aerobic endurance; however, it is difficult to ascertain the accuracy to which Max VO_2 can be predicted from distance run performance. The sample sizes used by the various investigators tended to be quite small. Over 50 percent of the researchers used sample sizes with N's of less than 25. The 95 percent confidence band for a correlation with an N of 25 is + .40; thus, the reported correlations will vary considerably due to chance. Since higher correlations are associated with more heterogeneous samples, the magnitude of these correlations are reflected by the variability of the sample studied. For example, Cooper (1968) reported a correlation of .90 between Max VO_2 and 12 minute run performance; however, the sample of 115 men varied in age from 17 to 52 years and in body weight from 114 to 270 pounds. This high correlation may, in part, be due to the heterogeneous sample studies.

Distance run tests are commonly called tests of cardiovascular-respiratory capacity or endurance. In a creative study, Kirk Cureton and associates (Cureton, Boileau, Lohman & Misner 1977) found that with a sample of children ranging in age from 7 to 12 years, the 600 yard and mile runs measures several different variables. Both distance runs were significantly related to oxygen uptake, but with path analysis, they showed that running speed and body composition accounted for more distance run variation that Max VO_2 expressed per unit of fat free weight. Cureton's study helps explain the factor analytic findings and significant correlations reported between distance runs and Max VO_2 per unit of total weight. Since body composition was not controlled, the isolated distance run factors measure both aerobic capacity and body composition. When Max VO_2 is expressed per unit of total weight, higher levels of fat weight will decrease the Max VO_2 values. Fat weight also decreases ones ability to run; therefore, part of the common variance between these variables is body composition and not cardiovascular function.

One source of evidences is often ignored. Numerous experimental studies have used various types of running training programs as an independent variable and Max VO_2 and body composition as dependent variables. Running programs sufficient in duration and intensity, not only improves distance running performance, but also increases Max VO_2 and decreases percent body fat. This provides strong evidence that running performance is related to important physiological components.

One goal of health-related physical fitness programs is to lower cardiovascular risk. A study by Cooper and associates (Cooper, Pollock, Martin, White, Linnerud & Jackson 1976) showed that higher levels of tredmill determined aerobic endurance was related to coronary risk factors. The higher one's aerobic capacity, the lower coronary risk. Belloc (1973) reported a relationship between mortality and self-report exercise habits. Lacking, however, are valid data to confirm that aerobic capacity is related to the incidence of cardiovascular disease. Kannel (1977, p. 84) states: "No prospective data relating physical fitness per se to risk of cardiovascular disease are available, and there is as yet no evidence that either coronary-prone persons or those with established disease have benefited from exercise programs. Nor has the optimal exercise prescription required been established."

The ultimate criterion for validating health-related physical fitness variables is morbidity and mortality. These are studies of the future.

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Cardiorespiratory Fitness as Compensatory Change

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When a child is tested for physical fitness his/her raw scores are typically compared with other children of similar age and expressed as a percentile (the percentage of students who scored below that point). If a child scores high on fitness test items it is taken as an indication of superior physical health and an apparent lifestyle which includes generous portions of vigorous physical activity. If a child performs poorly on a physical fitness test the prescription for improvement is to increase the student's frequency, intensity, and duration of physical activity. It is commonly assumed that anyone could reach the upper percentiles if he/she would just work hard enough.

These interpretations are based on the opinion that "physical fitness" is the body's capability to perform physical tasks. This view ignores the problem of contamination by factors not related to physical fitness which influence performance on fitness test items. Such an approach may not be warranted when one considers the nature and extent of individual differences in genetic potential and maturational rate.

When considering youth fitness, attention must be given to body size and changes in the body's composition which are influenced by physical activity. Changes in the relative amount of muscle, bone, fat, and in the functional capabilities of the cardiorespiratory and nervous systems have a pronounced influence on physical performance.

Changes in size and function which occur throughout childhood and adolescence are often considered as a single entity called growth. It may be more meaningful, however, to consider growth as consisting of two types, developmental and compensatory. Developmental growth is what one normally thinks of when considering the growth process. It represents the changes in body size and function that occur if certain minimums of diet, exercise and rest are met. Developmental growth is genetically determined and is regulated, in part, through the growth hormone, the sex hormones, and adrenal androgens. A child's maturational age (skeletal age) would provide the best indicator of his/her developmental growth status. Compensatory growth refers to adaptations that result from an increase in the functional demands placed on certain tissues and systems through exercise. These tissues and systems will grow at a certain rate and to a certain size (developmental growth), but if stressed through physical exertion will compensate for the overload by increasing their mass and functional capacity (compensatory growth). Since compensatory change reflects one's physical use or misuse of the body, it would be desirable if fitness tests measured only compensatory status. Unfortunately, they do not!

Performance on a fitness test is influenced by organic status (developmental and compensatory growth), skill, and motivation. Fitness test items are selected to control for the influence of skill and motivation so that an uncontaminated indication of organic status may be obtained. Organic status, however, is not a pure indicator of adaptation to physical work. Throughout childhood and adolescence, one's organic status is influenced by genetic and maturational factors as well as compensatory changes which have accrued as a result of habitual activity selection. Since there is little one can do to enhance the genetic and maturational foundations of developmental growth, it is compensatory status which would provide the best index of youth fitness.

One's level of cardiorespiratory fitness determines the ability of the organism to perform moderate work for a sustained period of time without distress to the individual. Cardiorespiratory function involves many factors such as the oxygenation of the blood in the lungs, cardiac output, vascular transport of the blood and oxygen to the active tissues, and the ability of the muscles to extract and utilize oxygen. (The single best measure of cardiorespiratory function is believed to be maximal oxygen uptake). Pretraining status influences the amount of improvement that will take place; however, regular endurance training can only increase maximal oxygen uptake an average of 20 percent (Astrand and Rodahl, 1970). It has also been noted that identical training regimes bring different individuals to various levels of maximal aerobic power (Lussier and Buskirk, 1977). Genetic endowment is thus a most important factor determining the individual's endurance potential.

Many field tests have been proposed for assessing cardiorespiratory function. Step tests and distance runs or "run-walks" have been most popular. Performance capacity on these youth fitness test items is influenced by efficiency and anaerobic tolerance in addition to aerobic power (Nagle et al., 1970). Efficiency and anaerobic abilities are influenced by physique, body composition, and one's proportion of FT and ST muscle fibers. Therefore, one's performance on a field test for cardiovascular fitness is biased by a strong genetic component.

A second problem with current youth fitness tests is the disregard paid to maturational differences. Youth fitness test scores are typically interpreted relative to chronological age. While age related norms are indicated because of growth, a false sense of precision may result. Clarke (1971) has shown that differences in maturity (skeletal age) are pronounced during all ages from 7 to 18 years. Data from the Medfort Growth Study showed maturity ranges that varied from 3.9 years at 18 years of age to 7.1 years at 13 years of age. Clearly, chronological age provides no more than an estimate of maturity.

Youth fitness tests provide information about the subject's ability to perform on each item; however, that performance reflects genetic and maturational as well as compensatory variables. This being the case, caution must be exercised in the use and interpretation of youth fitness test results.

If one feels that "physical fitness" is defined by some universal standard which stands immutable regardless of genetic or maturational status, then valid and reliable youth fitness tests can be used for individual, group, and program evaluation and prescription. A subject's score on each item reflects his/her "physical fitness" relative to all other individuals of similar age for that particular task. One must consider, however, that many students will never appear to be physically fit, because genetic and maturational factors may, in many cases, keep their percentile scores in the lower ranges. This may have a negative impact on a student's current feelings and future motivation for the commitment required to maintain a level of fitness throughout life.

If, however, one prefers a more individualized definition of physical fitness, which incorporates the idea that one's fitness status describes his/her state of being relative to genetic inheritance and maturity, then the range of uses for fitness tests is more limited and requires considerable caution.

The evaluation of groups or the physical fitness benefits of various programs would be acceptable because any reasonably sized sample would probably include a relatively representative distribution of genetic and maturational types. Thus, the group's performance when compared to normative values would reflect the compensatory status of the subjects relative to typical compensatory status for that age and sex.

Using the latter interpretation of physical fitness leaves the practitioner with limited applications for individual evaluation. An individual's performance is influenced markedly by genetic and maturational factors which have nothing to do with fitness when defined as compensatory status. The teacher has little idea whether the student is doing well or poorly relative to what he/she should be able to do.

Probably the best (though certainly not foolproof) method of evaluating an individual's progress in the pursuit of physical fitness is to follow him/her longitudinally by comparing the percentile scores over a multiyear period. Since genetic potential will remain constant and since there are percentile scales for each age group, an improvement in a student's percentile scores would give an indication of physical fitness changes relative to potential. Even this use, however, must be made with some caution because a child may experience longitudinal percentile fluxuation which could result from advanced or retarded maturity rather than compensatory change.

Change in percentiles can also be misleading because of the peculiarities in a percentile scale which is constructed from a normally distributed group of scores. Since there are few scores at the extremes and many scores near the middle of the scale, the same absolute improvement on a fitness test item results in a small percentile change for someone at the end of the scale and a much larger change for someone near the center of the scale.

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*A more complete manuscript, fully referenced, may be obtained from the author.

Identification of Some Conditions That Encourage Dance Injuries and Preventative Measures

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Dance kinesiology is the area of study which concetrates on the application of the principles of anatomy and kinesiology to dance. Although dance majors have been required to take kinesiology for some time, it is only recently that classes have focused exclusively on the kinesiological concerns that are unique to dance. This paper is an attempt to share some of the insights which have resulted from ten years as a dance kinesiologist. In the strict sense of the term, this is not a research paper, for I have not conducted formal experimental studies under controlled conditions, but there are many hypotheses implied, and at the close of the paper I shall identify some possible directions for future research.

The kinesiologist is frequently the first line of defense for injured students in a dance department. Consequently, the dance kinesiologist must exercise great caution and always refer students to the medical profession when there is any chance whatsoever, that the injury may need medical attention. The Modern Dance Department at the University of Utah has been very fortunate to have had the consutation services of Dr. Craig McQueen of Utah Orthopaedic Associates for the past two quarters. The advantages of having medical advice so readily available are obvious. We have all learned a great deal from Dr. McQueen's consulation sessions, and later in this paper, I shall share some of his suggestions.

The purpose of this paper is to identify certain conditions which can lead to common dance injuries. But before discussing specific conditions and injuries, I shall briefly discuss the general causes and prevention of injury in dance.

CAUSES OF INJURY

Arnheim(1975) lists a number of causes of dance injury, including poor body mechanics or postural inefficiency, lack of proper conditioning, fatigue, tension, and staleness. Each of these factors is critical in analyzing the causes of dance injury and many will be specifically considered, later in this paper. However, there are also many psychological factors which also contribute to the occurence of dance injuries.

Those of us who work with dancers are well aware of the special artistic intensity which is common. Technical perfection - not adequacy, perfection - is the goal of every serious dancer. Each dancer strives for that goal with a nearsighted dedication that usually obscures common sense. Patience with skill development is equally alien to most dancers. Each seems to want perfection, YESTERDAY. Although some athletes also exhibit this impatience and lack of common sense, the intensity seems to be of a higher order of magnitude for dancers. I do not wish to spend time discussing the philosophical and psychological causes of this intensity, but we must acknowledge it as a factor that contributes to dance injuries. We must realize that dancers do not, by nature, consistently use common sense in the studio. Nor do they approach their physical development with patience. I have found that one of the major roles I play in advising dancers about their physical

development is that of encouraging common sense and patience. I would be independently wealthy if I had a nickel for every time I have said, "Things take time," or "If it hurts, don't do it."

This last statement may have caused a stir of disagreement, for a common psychological set is that pain is a part of dance and that more pain is better. In my opinion, this mind-set is another main cause of dance injuries. How often has each of us heard the statement, "If it doesn't hurt, it isn't doing any good"? The critical factor here is the distinction between "good pain" and "bad pain."

A certain amount of pain is a necessary feature when building strength, flexibility and endurance, because of the overload principle. That pain is due to stressing bodily systems beyond their exsisting capacities in order to increase the capacity. This is the pain which I call good pain, for it results in increased physical potential. On the other hand, bad pain indicates an injury to the body. The distinction between good and bad pain is, at best, difficult to describe in words, but because the distinction is critical to the prevention of injuries, I shall try. Good pain is frequently characterized by dull, systemic, diffuse pain, whereas bad pain can be characterized by sharp, sudden, and localized pain. These descriptions are grossly oversimplified, yet they are included to focus attention on the importance of each of us making the distinction between good pain and bad pain. We must not tolerate bad pain and continue to move even though it hurts, for that can increase the severity of the injury. We must allow time for necessary tissue repair. It was bad pain that I referred to when I said, "If it hurts, don't do it." The inability to distinguish between good pain and bad pain is another critical cause of dance injuries to be added to our list. These three causes (lack of common sense, impatience, and inability to distinguish between good pain and bad pain) should be considered right along with body mechanics, conditioning, fatigue, and other causes of dance injury when we speak of injury prevention.

INJURY PREVENTION

Arnheim(1975) lists three major areas of consideration in the prevention of dance injury, including proper conditioning, adequate nutrition, and effective management of psychological stress (including tension management and relaxation). To these three categories of injury prevention, I would like to add a fourth: the conscious awareness of individual differences. This is not to imply that Arnheim does not consider individual differences, for he discussed them at length under other chapter headings. However, since one focus of this paper is personal injury prevention, I choose to add it as a separate category. Included in this category of conscious awareness of individual differences are at least four subheadings:

1. Awareness of one's own Achilles Heels (areas of past injury, muscular weakness, structural misalignment, and/or muscular imbalance)
2. Awareness of one's own strengths and special capacities
3. Awareness of individual indicaotrs of fatigue
4. Awareness of one's predominant movement style, including stylistic strengths and weaknesses.

Review of these areas of individual differences makes it clear that

a single prescriptive approach to injury prevention is not going to be equally effective for different individuals with varying backgrounds. It is therefore necessary for each dancer to increase self awareness, and for teachers of dance to familiarize themselves with the individual needs of the dancers in their classes. It is hoped that the remainder of this paper will help dancers and dance teachers identify certain conditions that need special attention and corrective exercises to prevent possible injury.

CONDITIONS THAT MAY LEAD TO TRAUMATIC INJURIES OR CHRONIC CONDITIONS

Certain areas of the body are more prone to dance injuries than others (Shaw, 1976). In this paper I shall pay particular attention to the following areas of the body: the ankle-tarsus region, the knee, the hip, and the lower back. It is obvious that in a paper of this length, it is impossible to cover all injuries or conditions. For that reason, I have subjectively selected those conditions which I feel are critical, most common for dancers, and most closely linked with traumatic dance injuries or chronic conditions. In working on this section of the paper, I was faced with a dilemma: whether to use scientific terminology and take the chance of losing some dancers who may not have had anatomy and kinesiology for some time, or to use common dance terminology and lose the precision and clarity of the scientific terminology. I realized that it would be best to use both, but the time and space limitations ruled out that possibility. For that reason, I have attempted to use common descriptions of the conditions where it is feasible, and scientific descriptions when they are more efficient.

Pronated Feet (Rolling in on the arches)

Pronation and supination are the movements possible in the tarsus region of the foot. If the foot is pronated in a weight-bearing position (standing), the foot will appear to be turned out, and the weight will fall to the inside of the foot. When an individual has restricted outward rotation at the hip joint, he or she may attempt to compensate by pronating the foot to get the appearance of hip turn-out. One of the problems resulting from pronated feet occurs at the knee joint. By pronating the foot, a rotary pressure, or torque, is applied at the knee joint. The constant twisting pressure on the knee can eventually cause a chronic condition. Furthermore, the dancer who habitually pronates the feet when the knees are extended (standing) is very likely to transfer that habit to the plié position. A plié with the feet pronated places the knee in its weakest position. Dance teachers have constantly reminded students to keep the knees over the toes in plié, but have sometimes neglected pronated feet when the knees were straight. The dance teacher should emphatically discourage the habit of pronating the feet by urging the student to lift the arch, thus shifting the line of weight transference laterally and changing the position of the knee to one that is more structurally sound.

The alignment of three bony landmarks is used to assess for pronation and supination of the tarsus region: 1) the medial aspect of the head of the first metatarsal, 2) the tuberosity of the navicular bone of the tarsus, and 3) the medial aspect of the calcaneous (heel). In ideal alignment of the tarsus, all three of these bony landmarks fall on the same saggital plane. When the head of the first metatarsal falls lateral to the line described by the other two landmarks, the foot is pronated. When the head of the first

metatarsal falls medial to the line described by the other two landmarks, the foot is supinated.

Pronated feet are more likely to cause knee injuries than supinated feet, because the medial side of the knee is structurally weaker than the lateral side (due in part to the lateral facial structure), and pronated feet transfer the weight to the medial side of the knee. This places greater stress on the medial side of the knee, thereby increasing the likelihood of injury. In addition to the potential hazards at the knee, pronated feet can also cause injuries at the ankle. There is a tendency for feet which are pronated in the normal standing position to supinate in a non-weightbearing position and in half toe or relevé position. This supination (called sickle foot in dance terminology) makes the ankle highly susceptible to sprains and strains. Because of the potential for injury at the knee and ankle joints, retraining of pronated feet is essential.

Retraining pronated feet involves building strength and muscular endurance in first, the muscles which supinate the tarsus and plantar flex the ankle, and second the muscles which pronate and plantar flex. Strengthening the first group of muscles will allow the dancer to adjust the foot to ideal alignment in a weightbearing position. Strengthening the second group of muscles will allow the dancer to stabilize the tarsus more effectively in relevé position. An effective aid for strengthening these muscles is an inner tube, cut cross-sectionally into heavy rubber bands. Loop the rubber circle around the leg of a chair, sit in the chair, slip the foot into the loop and, with the ankle plantar flexed, supinate against the resistance of the rubber band twenty to thirty times. Then pronate against the resistance, maintaining the plantar flexed position of the ankle, repeating twenty to thirty times. These two exercises will strengthen the muscles which are necessary for maintenance of ideal alignment of the tarsus (McQueen, 1978).

Misaligned Patella

The patella (knee cap) is located anterior to the intercondular notch of the femur. When properly aligned, the patella moves relatively freely against the notch, between the condyles of the femur. However, in some individuals the tibial tuberosity falls lateral to its normal placement. Since the patellar tendon, which incases the patella, attaches to the tibial tuberosity, a variation in the position of the tibial tuberosity can result in misalignment of the patella. Accompanying this condition is a syndrome called condromalacia of the patella which is a wearing away or grinding away of the posterior surface of the patella caused by the patella rubbing on the femoral condyle rather than riding freely between the condyles. According to Dr. McQueen (1978), the best way to reduce the grating is to increase the strength of the vastus medialis muscle. Since it is not possible to selectively strengthen a single vastus muscle, one must strengthen the entire vasti group. Using ankle weights to increase the resistance, the dancer should begin with an exercise which maintains full extension at the knee while flexing the hip. Once the dancer is able to easily lift approximately twenty-five pounds in this exercise it is safe to progress to the traditional knee exercises (going from a flexed position of the knee to extension, using ankle weights or a quadiceps machine) without putting internal stress on the knee. The dancer should then gradually work up to thirty repetitions with twenty to twenty-five pounds, twice a day (McQueen, 1978).

Lateral Snapping Hip

Most dance forms require that the dancer spend a considerable amount of time with the weight balanced on one foot. This requires a sub-maximal contraction of the abductor muscles of the standing hip to stabilize the pelvis. The continuous low grade contraction of the abductor muscles is not really sufficient to effectively build strength, and indeed, many dancers have very tight and weak abductors of the hip. The "snapping" occurs when the tight abductors slide over the greater trochanter of the femur. This most frequently occurs in two positions:

1. In the moving leg during a grande Ronde Jambe, as the leg starts down toward the floor there is a pop or click,
2. When the dancer stands in a relaxed posture with the weight dropped into one hip, the greater trochanter pops out to the side.

The snapping itself produces no apparent injury to the musculature, and there is usually no pain associated with the popping, but each time a snap occurs, the head of the femur is literally jammed into the acetabulum (hip socket). If continued throughout a dancer's career, this condition can cause bony erosion of the hip socket and the scar tissue can eventually calcify, distorting the shape of the acetabulum. Although this description of the snapping hip is hypothetical at this stage, I believe that this snapping hip phenomenon may be one reason for the high frequency of arthritic hips in older dancers.

Conditioning for the snapping hip involves both stretching and strengthening of the abductor muscles of the hip. Stretching the abductors allows the greater trochanter of the femur to move more freely beneath those muscles, and strengthening produces greater stability when the weight is on one leg. Weakness of the abductors causes a problem which is common in beginning dance classes: the sagging into the standing hip when the weight is on one leg, or, what dancers refer to as not being "on" the standing leg. At Utah we have a small research project plannned for Spring Quarter, to investigate the effect of increased hip abductor strength on pelvic alignment and duration of balance, when the weight is on one leg. I hope to report the results of that research at some furture convention.

To strengthen the abductor muscles, lie on one side with the feet and legs in parallel position (NOT turned out) and, maintaining parallel position, lift the leg to the side, as high as possible, twenty to thirty times. In the initial stages of conditioning, just the weight of the leg is sufficient resistance to build strength, but as strength increases, use ankle weights to increase the resistance.

To stretch the abductor muscles of the right hip, assume a lunge position with the left leg forward and the hands on the floor on either side of the forward leg. While supporting some of the weight with the arms, turn the torso to the left so that the right leg is extended and adducted. Allow the weight to sag into the right hip, maintaining an extended position at that hip, thereby increasing the adduction and stretching the abductors. Hold the stretch for thirty seconds to one minute. Repeat both the strengthening and stretching exercises on both sides.

Sciatic Syndrome

Another position which is characteristic of dance is outward rotation of the hip joint. Maintenance of outward rotation is almost continuous in some dance classes. Conversely, little or no time is

spent working with the hip inwardly rotated. It is not unusual for the outward rotators to be very tight in dancers, as evidenced by a marked muscular imbalance allowing great range of motion in outward rotation and little or no range of inward rotation. The six deep rotators, which are located in the buttocks beneath the gluteus maximus, are frequently very tight in most dancers. The sciatic nerve weaves through the six deep rotators, passing under some and over others. As tension of the six deep rotators increases, accompanying the constantly held outward rotation, these muscles can eventually go into spasm (cramp) and pinch the sciatic nerve. When this occurs, the pain will frequently radiate down into the leg; behind the lateral side of the knee and on down to the peroneal muscles on the lateral side of the calf. In extreme cases, those muscles of the leg may actually go into spasm. Stretching the outward rotators can reduce this problem. One easy exercise for stretching the six deep rotators is to assume a standing, toed-in position and, maintaining internal rotation at the hip joint, stretch the posterior muscles by flexing at the hip as far as possible, as if to touch the toes. Hold the stretch for at least one minute. Another good, but more complicated,exercise for stretching the six deep rotators is what I call the "Yoga-Sit" position. Sitting with the right leg folded so that the heel is close to the left buttocks, and the left foot placed to the right of the right knee, hold the left knee with the right hand and turn the torso to the left, stretching the deep rotators on the left side. The stretch can be increased by pulling the left knee closer to the body and pressing the "sit bone" to the rear. Hold the stretch at least one minute and repeat on the other side.

Tight Hip Flexors

In this culture we do a lot of sitting and this truism is equally applicable for dancers. (Yes, even dancers find time to sit occasionally.) Because of the amount of time we spend seated (flexion of the hip), the hip flexors have ample opportunity to shorten. Generally, the hip flexors either attach to, or cross over, the front rim of the pelvis. When the hip flexors are tight and one extends the hip, the tightness of the hip flexors will pull the front rim of the pelvis down, giving the buttocks a protruding appearance and forcing weight compensation in the lumbar spine, evidenced by lumbar lordosis (sway back). In the past, the presription for correcting lumbar lordosis focused on stretching the extensor muscles of the lower back. In my opinion, these exercises worked on the effect of the problem and not the cause: the tight hip flexors. My corrective work with dancers with lumbar lordosis has shown that relatively rapid realignment is frequently possible by stretching the hip flexors. While stretching the hip flexors, it is critical to stabilize the position of the pelvis by contraction of the abdominal muscles. Without contraction of the abdominals, the pelvic inclination can be increased, thus reducing the amount of stretch on the flexors. If tight hip flexors are ignored, both traumatic injury and chronic lower back pain can result from the misalignment.

One exercise to stretch the hip flexors starts in a standing position with the right knee bent and the right hand holding the right ankle, so the heel is as close to the buttocks as possible. While contracting the abdominals to stabilize and lift the front

rim of the pelvis, gently pull with the right hand so the position of the right knee is slowly and steadily shifted backward. Care must be taken to keep the lower leg aligned with the upper leg to prevent twisting of the knee. Hold the stretch for thirty seconds to one minute and release gently. Repeat on left.

CONCLUSION AND DIRECTIONS FOR FUTURE RESEARCH

In this paper, I have attempted to identify a few conditions which encourage dance injury, but this is by no means a complete list. Many conditions have been deleted in the interest of staying within the time and space allowed. However, from the examples discussed, I feel it is blatantly clear that research is desperately needed in the field. Dancers are pitifully neglected when it comes to extensive research on the care and prevention of injury. Part of the fault for this must be placed on dancers, for we have thought of ourselves as artists, and have scorned the science of human motion. This separatist attitude regarding art and science must be set aside, for the science of motion facilitates the art of dance. Although some members of the medical profession and some trainers have begun to focus on dance injuries, most of them are not dancers and therefore are not familiar with the particular physical demands of dance. It is our responsibility, as dancers and dance educators, to work side-by-side with the medical profession, trainers, and researchers in directing future research.

The potential for research in dance kinesiology are, from my point of view, limitless. We desperately need sound research on: the relationship between body composition or body type and propensity to certain types of injury; kinesiological analysis of the physical demands of dance; design and evaluation of corrective exercise programs; design and evaluation of efficient general exercise programs; and longitudinal studies to identify long-range effects of dance training, to name only a few areas of potential research. I have only touched the surface of needed research in this paper. However, I sincerely hope that this will serve as a catalyst for further analysis of the particular demands placed on the dancer, so that dance, as a profession and as an avocation, can become safer and healthier for participants.

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Attitudes and Values Associated with Youth League Football Competition

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The following survey encompassed the Young American Football League (YAFL) of Albuquerque, New Mexico and the Ute Football conference of Salt Lake City, Utah. Subjects were boys 9 through 15 years of age (N=531), parents of participants (N=365), Youth League coaches (N=125), and High School coaches (N=111) for a grand total of 1131 subjects. The primary intent was to ascertain the attitudes toward the values held by each of these population groups regarding youth league competition in football.

How beneficial or detrimental is age level football? Is it organized properly? Are the coaches involved good, average, or poor leaders and models? Why is participation in this sport so attractive to boys? What benefits do boys derive from such participation? What steps or procedures would improve this endeavor? These and many other questions of a similar vein were the underlying reasons for this research project.

It has been a commonly accepted fact that participation in age group programs, expecially at the pre-puberty age (8-12) is of great value to any young boy (and possibly girls). Experts have noted that competition at this tender age contributes to the development of character, confidence, self-control, sportsmanship, stress management and numerous other beneficial personality attributes. But on the other hand, Youth League competition in general has also received the brunt of a plethora of negative comments and/or strong criticisms.

Readily apparent was the thought that the controversy surrounding the values of such competition was no where near being resolved because very miniscual empirical data were available specifically relating to the subject. It is no easy task to gather data where everyone, yet no one, is an expert. In an effort to acquire information that was more objective in nature, four similar but different questionnaires were developed and administered to each of the selected population groups.

Surprisingly enough, the surveys conducted in both communities indicated very similar results. The obtained date should be viewed in the context of "what was" at a particular point in time and certainly not as "why" or as an attempt to attribute a "cause and effect" relationship. Presented in the following four subsections are the important findings.

PLAYERS

The players generally expressed the attitudes that their coaches were fairly good and that in order to perform well, they (the players) needed to work hard. Players were unsure as to whether or not Youth League Football was serious business, but 90% of the players were convinced that trophies should be awarded to winning teams.

One of the most interesting findings was the players' perceptions of their parents involvement in Youth League Football. A majority of the players felt that their parents were definitely interested in their performances. Conversely over half of the

players said that their parents "chewed them out" if they performed poorly. Also, one third of the players stated that their parents behavior during games affected they (the players) performances.

Possibly the most significant finding involved the boys attitude toward winning and losing. Having fun was more important than winning to over 95% of the boys. For example, 75% of the players stated that they would rather play on a losing team than sit the bench on a winning team.

The values that the players received from participation in Youth League Football, according to their own perceptions, were: learning about football, learning how to work with others, learning sportsmanship, having fun, and meeting new friends.

PARENTS

Parental attitudes from both communities depicted numerous agreements and also a few disagreements. Parents were hesitant to concede that Youth League Football aided their boys in learning to handle stress. All parents expressed the thoughts that this type of competition taught their boys responsibility and that it did not detract from their sons' study habits or performance in school.

Parents agreed with the players, but not as strongly, that it was more important for the boys to play even on a losing team, rather than sit the bench on a winning team. The values of Youth League Football according to parents were: learning football, teamwork, fun, sportsmanship, conditioning, and learning discipline.

YOUTH LEAGUE COACHES

The Youth League Football coaches from both communities expressed the most positive attitudes and values surrounding this level competition. The main difference occurred in the area of emphasizing winning. The Salt Lake City coaches placed more emphasis on winning than did the Albuquerque coaches, but the Salt Lake City coaches also had more problems with parents than did the coaches from Albuquerque. Another glaring difference was that the coaches from Albuquerque felt strongly that every boy should have the opportunity to play whether his team is winning or losing the game; but the coaches from Salt Lake were not as adamant on this point.

The values of Youth League Football competition according to Youth League coaches were that it fosters teamwork, sportsmanship, and enhances mental and physical development.

HIGH SCHOOL COACHES

The High School coaches who responded from both communities expressed the majority of the negative attitudes towards Youth League Football competition. High School coaches were not confident, in either community, that proper football fundamentals were being taught. They expressed strongly that many Youth League coaches were unqualified and this was possibly a contributing reason that numerous boys were being "burned out" before reaching the high school level. High School coaches also expressed the idea that Youth League offers too many expensive rewards and trips.

SUMMARY

The results of the surveys administered in Albuquerque, New Mexico and Salt Lake City, Utah provided the following conclusions: (1) Players, for the most part, had positive attitudes towards Youth League Football competition; (2) Parents in both communities favored this level of competition and were the least

critical of the groups surveyed; (3) Players and adults disagreed as to the values of this level of competition; (4) Youth League coaches were extremely positive in their attitudes and values; and (5) High School coaches, in both communities, supported the theory behind Youth League Football but were the most critical of many of the practices being adhered to at this level of competition.

Both communities and all subgroups (players, parents, Youth League coaches, and High School coaches) expressed the idea that Youth League Football is more beneficial than detrimental to the development of young boys. Due to this feeling and the results of the research, the following guidelines for Youth League Football Programs are advocated.

GUIDELINES:

(1) Eliminate parental problems in so far as it is possible. Parents should be advised not to attend practices. (2) No spectators at the games. (3) Extrinsic rewards should not be given. (Letter jackets, trophies, medals, etc.) (4) No post season competition. (5) Expensive trips for "winners" or "champions" are frivolous and unnecessary and therefore should be discountinued. (6) Teams should be organized according to player's age, weight, and skill ability. (7) All boys must play at least one quarter of each game (8 minutes). (8) Coaches should be carefully selected according to predetermined criteria. (9) All coaches be required to attend clinics sponsored by the state high school associations or other related affiliations. (10) Emphasis be placed on learning the fundamentals of football and the enjoyment of playing rather than on winning.

Eliminating parental problems should be the number one priority, in most programs. Parents appear to be the predominate cause of the pressures on both coaches and players. If the true concern of Youth League Football is for the participants, then why have parents or spectators. A fundamental law of learning is to practice in private and once you have mastered the skill, then perform in public. In reality, Youth Leaguers are not extremely proficient and too young to be shouldering the pressures of public performance. Spectators, including cheerleaders, bands, etc. serve no useful purpose ot a youngster's performance. In fact these added distractions may impair rather than enhance a boy's performance. Eliminating these psychological pressures should allow the boy to concentrate or enjoy the true values of this type of competition. A fourth of the players themselves indicated that they participated due to parental pressure; one-third of the Youth League coaches stated that boys participated to please parents; and three-fourths of the high school coaches cited parent and peer group pressure as a primary reason for boys participating in Youth League Football.

The very fact that something materialistic is offered in the form of an extrinsic reward makes the entire endeavor a little suspect. Why are these monetary rewards necessary? If the program is run correctly, then boys should want to play and enjoy the participation and competition without having to be rewarded. The awards serve possibly as positive reinforcers for those who receive them but think of the countless youngsters who are negatively reinforced because they receive nothing at the Awards Banquet. Youth League can be just as attractive to boys without these expensive rewards. Just think of the money that can be saved and put to more useful purposes. Along these same lines is the "big trip" awaiting the champions at the end of the season. These two surveys revealed that these trips are really not

necessary. Take this same money and purchase more and better equipment; field more teams so additional boys can participate; or maybe sponsor clinics for the coaches. Another thought along this line is that these trips may spoil a young boy for future competition. What can a high school offer the youngster who has flown all over the country. Probably no more than a bus trip across town. What a let down. The critical point is that the present incentive systems need to be restructured in order to promote intrinsic rewards instead of high-priced extrinsic rewards which normally gather dust and are quickly outgrown or placed in storage. Wound't it be better if lasting, positive reinforcers were provided instead?

Eliminating post season competition is a real drastic step. But again, what are the purposes of these games: Who do they reward? The two surveys revealed that this was an area which generated mixed opinions. Players and parents were not positive about the values of post season playoffs, while most coaches were not in favor of them, at least as now organized. These playoffs cause undue pressure on coaches, players, and officials. There is plenty of time to expose youngsters to these levels of intense pressure in high school and college. There is not one shred of evidence that supports the myth that this helps make a better man. Conversely, it may provide the foundations for poor winners and losers. Perhaps we could learn from our European neighbors who do not promote intense competition until a child reaches his earlier teens. Before this time, all boys and girls are encouraged to participate.

For safety purposes the age, weight, and skill level of a boy should be a consideration in team formation. If a boy is placed in a heterogenous group then the rich get richer and the poor are gradually eliminated or excluded. On the other hand, through homogenous grouping, the boys realize that all of their teammates are pretty much in the same boat, therefore the situation becomes less threatening, more learning evolves, and a greater sense of enjoyment is realized.

Similarly, all boys who practice regularly and are in good health should be provided the opportunity to play in each game no matter who the opponent. Over 75% of the boys from Salt Lake City and Albuquerque expressed the idea that they would rather play on a losing team than sit the bench on a winning team. It was interesting to note that the parents from Salt Lake placed more emphasis on winning than playing in comparison to the Albuquerque parents. Youngsters Want to Play, Attitudes Toward Winning Are Learned.

The coaches at the Youth League level serve a vital, yet often-times thankless role. These men donate time, energy, effort, and money to helping youngsters. These men are truly to be praised. Because of the nature of their position, Youth League Football coaches should receive training both in the football area and in understanding the needs and interests of young boys at the various age levels. There is a difference between a nine year old and a fifteen year old. These clinics could be easily sponsored by the State High School Activities Association or some related affiliation. At these clinics, high school and college coaches as well as educational psychologists could explain how to and why. This slight amount of training could easily supplement the knowledge the coach already possesses. In addition, all coaches need a basic knowledge of first aid and minimal training procedures. These clinics should also be designed so that parents could attend and acquire a clear understanding of the objectives and philosphy

of the league and this age level competition.

This research revealed that the following characteristics were most often perceived as essential for a Youth League Football coach: (a) Knowledge of football (b) Fair, (c) Flexible, (d) Knowledge of boys at each age level and (e) a Good Model. When a man has these qualities, then he will tend to be an asset to a program, but if he does not, then he may be more of a liability.

By adhering to the above guidelines it would appear that a program of football can be implemented which represents the true values of this level of competition. Incidentally, the values of Youth League Football according to the participants were: (a) Learning the fundamentals of football and (b) Enjoyment of playing.

As can be readily deducted, all of the guidelines and the values and attitudes expressed in these two surveys were contrary to the concept of winning. If the guidelines are followed there is an opportunity to develop good, solid, young men who know the true meaning of sportsmanship, fun, and an appreciation for competition that is kept in proper perspective. The result will be an honest attempt to prepare good losers as well as good winners: and more important, a foundation will have been laid for an individual who loves the sport for its inherent values instead of relying on the fleeting hope of always winning. After all, winning is no more commonplace in life than losing, and what is really needed are more people who participate just for the challenge. Youth League Football is for youth---let's give it back to them--- please.

A Survey of Parental Attitudes Toward Competition in Youth Soccer Leagues

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Statement of Problem The problem of this study was to investigate the attitudes expressed by parents of six-, seven-, eight-, and nine-year-old boys toward competition in the Carrollton-Farmers Branch, Texas Soccer Association during the 1976-1977 soccer season.
Procedures The data for this study was obtained from a survey questionnaire which was distributed to parents of boys participating on seven teams in an under-eight age group (consisting of boys six and seven years of age) and on seven teams in an under-ten age group (consisting of boys eight and nine years of age). The instrument for this study was Scott's Attitude Inventory (Scott, 1953) for measuring attitudes toward athletic competition at the elementary school level. A Likert procedure was used to measure attitudinal responses to each inventory statement. Data was analyzed through the use of analysis of variance and t tests. Also, percentages were computed to determine if parental attitudes were favorable or unfavorable toward competition in youth soccer leagues. The .05 level of confidence was used to test for significance.
Analysis of Data Fisher's t test was used to determine whether or not significant differences at the .05 level existed in attitudes between the four parent groups. An analysis of variance was utilized to ascertain if one parent category within the two groups differed significantly in attitudes toward intensive competition. The four parent categories within the two divisions were as follows: 1) male parents in the under-ten division, 2) female parents in the under-ten division, 3) male parents in the under-eight division, and 4) female parents in the under-eight division. Comparisons made among the four parent groups by an analysis of variance revealed no statistically significant differences in attitudes toward intensive competition in the Carrollton-Farmers Branch, Texas youth soccer leagues with the exception of one parent group. The statistically significant difference appeared between the attitudes of mothers of sons and the attitudes of fathers of sons in the under-ten age division. Mothers of sons under-ten years of age expressed a significantly more favorable attitude toward soccer competition for their sons than did fathers of sons under-ten years of age.
An analysis of variance of the attitudinal responses of parents of boys in the under-ten division and

parents of boys in the under-eight division revealed that seven (7) of the seventy-nine questionnaire variables were statistically significant. The seven significant variables were:

1. This type of participation enables most individuals to work off emotional tension.

Parent groups P-10 and P-8 tended to agree with the statement. Parent group P-10 exhibited a significantly stronger agreement with the variable than P-8. This finding suggested that parents considered intensive soccer competition to be a more acceptable emotional tension release activity for eight and nine year old boys than for six and seven year old boys.

2. Participation tends to put most individuals in a state of emotional upset for a longer period of time.

Parent groups P-10 and P-8 tended to disagree with the statement. Group P-10 varied from group P-8 in that their disagreement was significantly less. These parental attitudes suggested that the parents surveyed in the questionnaire felt that as children grow older and are exposed to more intensive competitive athletic situations, they tend to become more emotionally upset and remain so for a longer period of time.

3. Participation gives most individuals mental relaxation after the pressure of the game is over.

Parent groups P-10 and P-8 tended to agree with the statement. Group P-10 varied from group P-8 in that their agreement was significantly greater. The data suggested that they felt that as children become older and more skilled, the pressure created by a game situation appears to become more intense.

4. The skilled person needs this type of participation in order to stimulate him to develop his physical skill further.

Both parent groups strongly agreed with the statement. Group P-8 varied from group P-10 in that their agreement was significantly greater. The data suggested that the parents felt that as a skilled person becomes older, the need for intensive competition as a stimulus for greater skill development begins to diminish.

5. Participation teaches most individuals to win without boasting in public.

Both parent groups agreed with the statement. Although group P-8 agreed significantly stronger with the statement, group P-10 approached a value indicative of neutrality or indifference. The data suggested that the parents felt that the older the player, the more he would tend to publically boast of his athletic success.

6. Participation gives many individuals a feeling of inferiority if beaten often.

Parent groups P-10 and P-8 both tended to agree in their assumption of a position of neutrality or

indifference regarding the statement. Group P-8 varied significantly, however, by veering toward a positive position of disagreement with the statement. The data suggested that the parents felt that the younger players exhibited fewer feelings of inferiority than did the older players as a result of being frequently defeated. This finding would additionally suggest that the emotional impact of intense competition increases with age.

7. Injuries in this type of competition are often exaggerated because they make good news items.

Parent groups P-10 and P-8 tended to agree in their assumption of a position of neutrality or indifference regarding the statement. Group P-8, however, varied significantly from group P-10 in veering toward a position of agreement with the statement. The data suggested that the parents felt that injuries sustained by younger competitors were more likely to be exaggerated in media reporting than injuries sustained by older competitors. This finding, along with the articles included in the review of literature, greatly supported the feelings of concern expressed by professionals in the field of recreation for the welfare of youth presently participating in intensive sports competition at extremely young ages.

Conclusions

1. Mothers of sons participating in the under-eight soccer league division possess a positive attitude toward intensive competition, but not as positive as mothers of sons in the under-ten division.
2. Fathers of sons participating in the under-ten soccer division have positive attitudes toward intensive competition, but not as positive as fathers of sons in the under-eight age division.
3. Mothers of sons in the under-ten age division have a more positive attitude toward competition for their sons than do fathers of sons under-ten years of age.
4. Intensive soccer competition found among boys six through nine in age is viewed as being positive by both male and female parents.
5. Parents feel intensive soccer competition allows boys to work off emotional tension.
6. Parents maintain that intensive soccer competition does not put most individuals in a state of emotional upset for a long period of time.
7. Parents feel that after the pressure of an intensive soccer game is over, most individuals exhibit mental relaxation.
8. Parents feel that a skilled person needs intensive soccer competition in order to

stimulate him to develop his physical skills further.

9. Parents feel that intensive soccer competition teaches most individuals to win without boasting in public.
10. Parents feel that intensive soccer competition gives many individuals a feeling of inferiority if defeated often.
11. Parents feel that injuries resulting from intensive soccer competition are not exaggerated for the purpose of creating news items.

Recommendations

1. A study of parental attitudes toward intensive soccer competition should be conducted in a lower socio-economic area to determine if any significant differences in attitude exist.
2. A study of parental attitudes toward intensive soccer competition should be conducted with parents of girls participating in soccer leagues to determine if significant differences exist in attitudes toward competition for girls and toward competition for boys.
3. A study of parental attitudes toward intensive competition in other sport activities should be conducted to determine if a significant difference in attitude exists toward competition in different sport activities.
4. A study of the attitudes of the participants in a soccer league should be conducted to determine if significant differences exist as an indication of age, experience, and/or ability.
5. A study should be conducted to determine if the attitudes of parents and coaches significantly differ regarding intensive soccer competition.

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A New Leisure Attitude Scale

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This paper provides a very brief introduction to a new scale designed to measure the positivity of people's attitudes toward leisure. Preliminary evidence of reliability and validity is presented as well as suggestions for the use and further validation of the scale. Further details about the scale are available from both authors.[1]

Social commentators often make statements about the relative importance of leisure and work in society, usually suggesting that leisure is increasing in importance. Several scales exist to measure a Protestant ethic orientation which values work highly (2,3,5). An analogous scale measuring leisure orientation would be very useful in monitoring changes in societal leisure attitudes. Such a leisure ethic scale may also be able to predict participation in, and support for, leisure programs and changes due to leisure education or counseling. It should also contribute to our understanding of work attitudes, mental health, and life satisfaction.

The major existing scale of the positivity of leisure attitudes was developed by Burdge. He has now concluded that new methods of measuring leisure attitudes are needed (2).

Two other scales measure the positivity of attitudes toward leisure. Neulinger (4) has a lengthy form called a "Study of Leisure." Neulinger and others have administered it to several populations and found that it has five factors, which have been named affinity for leisure, society's role in leisure planning, self-definition through leisure, amount of perceived leisure, and amount of work or vacation desired. Five items clustered onto the factor called affinity for leisure--the factor with which naturally, we are the most concerned. Four of these five items concern the idea of living a life of complete leisure; the fifth item asks the respondent to divide his waking hours into desired amount of work time and free time. The affinity items are sandwiched within the total scale. Little data is available on this particular subscale and its content is rather narrow to represent general positivity toward leisure.

The concept of a leisure ethic scale has also been dealt with by Bryan and Alsikafi (1). In order to study the work and leisure attitudes of University of Alabama professors, they used 22 attitude items dealing with work, with leisure, or with both.

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These items were found to factor into three groups, subsequently called the Protestant work ethic factor, the leisure ethic factor, and the work-leisure fulfillment factor. The Protestant work ethic factor resembles other measures of the work ethic; the work-leisure fulfillment factor deals with things like self-respect or personal fulfillment gained either through leisure or work. Five items loaded on the leisure ethic factor. Four of these items force a work-leisure contrast as in:

"I feel that my leisure activities provide me with an escape from my work."

This scale has also been little used and little data are presented about it. It is also closely tied to a contrast between work and leisure.

In developing a new leisure ethic scale we were able to build on several past scales both in choosing items and in testing validity. Unlike past scales, the positivity of attitudes toward leisure was kept independent of work attitudes since no items contrasted work and leisure.

SCALE DEVELOPMENT

Several steps were taken to sequentially develop the version of the scale presented here. First, approximately 150 items concerning attitudes towards both work and leisure were gathered from existing scales of work or leisure orientation and generated by the experimenters. This package of scales and items was tested and analyzed on a sample of 300 students. On the basis of their comments, item frequency distributions, item-total test correlations, factor loadings, and a validity check, this item pool was reduced to 44 items concerning attitudes towards leisure.

Second, the 44 items were revised slightly and administered to another student sample. Based on further analyses of reliability, validity and conceptual factors this version was reduced to the 22 best items. The 22-item version was administered to a group of over 100 people in the Champaign, Illinois area who approximated a quota sample of the United States with about 50% each male and female, 10% black, etc. This questionnaire also contained items asking how much time the respondent spends daily in leisure. Other background characteristics were also assessed.

This version was also administered to student criterion groups of business and leisure majors who were expected to differ in their attitudes. It was also administred to students at two universities for two, four and five week test-retest reliability and to 24 pairs of roommates who also rated each other. Finally, based on all available data, the scale was reduced to the 19 best items. These items are presented here for further use by others.

RESULTS

Most data are presented from the 22 item scale here. The 19 item scale is being tested further and because of the way items were selected should be better than the 22 item version on all of the following criteria.

Internal Consistency. Correlations were done between each item and the total test score with that item removed. All items correlated significantly with the total score, most at the .001 level. The median correlation was .38. Cronbach's alpha finds the average split-half correlation if the scale were divided into all possible halves. Analyzing the data collected on the quota sample, a Cronbach's alpha of .81 was obtained, a very high value.

Test-Retest Reliability. Another index of the reliability of a scale is its stability over time. Three test-retest intervals were assessed to determine the stability of the LES. One group of students took the scale two weeks apart, one group took it four weeks apart, and a third took it five weeks apart. In all three cases, there was a significant positive correlation between the total scale scores obtained at time one, and at time two. The two-week interval provided a correlation of .58 and the four and five-week intervals yielded correlations of .87 and .85 respectively. The unexpected lower value of the two week test-retest may be an artifact. Further data will be collected.

Criterion Group Validity. The most striking evidence for scale validity was found in our test of criterion-group validity. The primary prediction made here was that leisure studies majors would score significantly higher on a scale of leisure ethic than would business majors. Presumably, someone motivated to study leisure in the first place values it highly, sees it as an important part of life, and wants it in their own life. Secondly, the differential orientations received in these two academic majors would tend to foster higher regard for leisure among the leisure studies majors. Total scores on the leisure attitude survey differed on the average by seven points, the business students averaging a complete standard deviation below the leisure studies students. Furthermore, on 17 of the 22 items there were significant differences in the way the two groups answered, the leisure majors always answering in the more pro-leisure direction.

Peer Ratings. The peer rating analysis consisted of comparing a student's score on the scale with a peer's opinion of that student's leisure attitude. Pairs of roommates were asked first to complete the LES as usual; they were then asked to fill out the LES as the roommate would if he were answering honestly. The ratings of the peers then, provide an informed outsider's appraisal of the subject's attitude toward leisure. The correlations in this case represent a conservative estimate of validity because the peer was not asked to answer as he thought his roommate would, but rather as he felt his roommate should. The results of the peer rating analysis, though not overwhelming, do support the content validity of the leisure attitude scale. Total scale scores on the LES correlated .24 ($p<.05$) with a peer's appraisal of a subject's leisure ethic.

Construct Validity. Construct validity is assessed through the confirmation of expectations, based on a network of empirically and theoretically deduced relationships involving the given variable. In the case of leisure attitudes, Burdge's earlier work found a high correlation between leisure orientation and education, age (negative correlation), and participation in outdoor recrea-

'tion. The current scale similarly correlates significantly with education (.16) and age (-.22). Further, a shorter version of the scale was a signficant predictor of wilderness use and intentions to use wilderness.

DISCUSSION

The most important result of this research on leisure attitudes is the formulation of a usable, reproducible reliable and valid scale to measure the leisure ethic. Although testing and validation possibilities are by no means exhausted, we feel that the extensive data collected thus far on this scale combine to make it the best available tool for measuring affinity for leisure.

The newly formulated Leisure Ethic Scale replicates some of the previous findings in leisure attitude research, but also corrects some of the past problems. The items are stated with both positive and negative wording so that agreement does not always signify a pro-leisure attitude. As opposed to all previous scales, no item in the LES forces the respondent to make a choice between liking leisure and liking work.

One major setting in which this new scale can be utilized is in the area of leisure counseling. The leisure ethic scale is an instrument which can serve as an initial diagnostic tool, provide a format for thought-provoking discussion, and measure the efficacy of leisure counseling interventions. Pre- and post-testing on the LES is an easy and economical way for leisure professionals to know if their interventions are successful. Data of this sort would be a particularly valuable test of the validity of this scale.

A second major setting where the leisure ethic scale can be utilized is anywhere that the assessment of current leisure attitudes or the direction of future leisure trends is an issue. This scale could document social changes in the acceptance of leisure which people have increasingly speculated about in recent years.

We expect to collect further data on the scale shown here. We hope that people will use it and inform us of the results, particularly in leisure counseling settings. We will then be able to continue to improve and validate the scale for future users.

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Leisure Attitude Scale

This scale measures your attitudes toward leisure. By this we mean how you feel about your leisure, your recreation, or the things you do in your free time. Please answer as quickly and accurately as possible by indicating whether you agree or disagree with each of the following statements.

	Completely Disagree	Moderately Disagree	Moderately Agree	Completely Agree
1. My leisure is my most enjoyable time.	_____	_____	_____	_____
2. I admire a person who knows how to relax.	_____	_____	_____	_____
3. The thought of retirement scares me.	_____	_____	_____	_____
4. I like to do things on the spur of the moment.	_____	_____	_____	_____
5. I often feel guilty when I am having a good time.	_____	_____	_____	_____
6. I like my leisure.	_____	_____	_____	_____
7. It is bad for adults to be playful.	_____	_____	_____	_____
8. I would like to lead a life of complete leisure.	_____	_____	_____	_____
9. Most people spend too much time enjoying themselves today.	_____	_____	_____	_____
10. I don't feel guilty about enjoying myself.	_____	_____	_____	_____
11. I don't know how to relax.	_____	_____	_____	_____
12. People should seek as much leisure as possible in their lives.	_____	_____	_____	_____
13. I'd like to have at least two months vacation a year.	_____	_____	_____	_____
14. Leisure makes me feel good.	_____	_____	_____	_____
15. I do not express myself through my leisure.	_____	_____	_____	_____
16. Leisure is great.	_____	_____	_____	_____
17. It is good for adults to be playful.	_____	_____	_____	_____
18. I should not overindulge in leisure.	_____	_____	_____	_____
19. One should feel a sense of pride in one's leisure activities.	_____	_____	_____	_____

Computer Matching of Personality Profiles with Avocational Activities

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PROBLEM

In 1850 the average work week was 70 hours. By 1900 it had dropped to 60 hours; to 44 hours in 1940; to 40 hours in 1950, and to 37½ hours in the 1960's (Hartlage, 1968). Thus the average decline in the hours spent working each week has been 4 hours for each decade since 1900. In terms of free time, this means that the average worker in the United States has 3,700 free hours per year, or 270 full days of 16 hours available for leisure types of activities.

Life span has also played a part in the increased amount of time available for leisure activities. A century ago, man worked 70 hours per week and had a life expectancy of 40 years; this ratio is now nearly exactly reversed. Not only do we have more leisure hours per year, but we have many more years. In the last 100 years we have gained 1,500 leisure hours per year, plus an additional 30 year life expectancy, for the equivalent of 22 years of leisure added to our lives since 1873. This trend shows signs of continuing.

The implications of increasing leisure time, in a country still strongly rooted in a work ethic, can be of serious psychological consequence for such variables as self concept, self esteem, and related measures of worth which people have traditionally derived from their work. Traditionally, for example, a person's identity has come from his job; since that was how he spent most of his time. Currently, however, the average adult American spends 15.6% of his time at work, with 34.8% at some leisure related activity.

It is possible, choosing from among a wide variety of available vocational tests, to predict the likelihood that a man will function satisfactorily in a given vocational pursuit or cluster of occupational activities (Super & Crites, 1962). Since the early years of World War II, vocational screening batteries have been available, and have been generally accepted as having proven their worth.

Although man is shifting the development of his time from a vocational to an avocational emphasis, the available psychotechnology has not been responsive to this shift. Compare, for example, the availability of tests for measuring vocational interests against the availability of tests for measuring avocational interests. Even in our current ratio of better than a 2:1 leisure: working hour schedule, the proportional ratio of tests for measuring vocational versus avocational interests is grossly disproportionate.

This paper describes a project aimed at developing a procedure for helping match individuals with appropriate leisure activities, using techniques found to be of value in vocational matching programs.

METHOD

Subjects

For the initial developmental stages a random sample of 365 Ss stratified for age, sex and occupational level were involved. For the cross validation stages, 1000 Ss representing primarily employed adults at all occupational levels were involved.

Instrument

The test consists of 70 different items arranged in forced choice format for a total of 200 questions. The test avoids references to specific avocational areas, as such, in order to avoid any possible tendencies to choose avocations or slant responses. Typically, the respondent chooses groups or constellations of activities which are correlated with a given avocational field. By summing correlations of each item answered with each avocation, the computer thus directly matches each item with each avocation for each individual taking the test.

The forced choice method is used throughout. There is evidence that when items are presented singly, it is often difficult for the respondent to decide whether he likes, dislikes, or is neutral regarding a given choice (Lee & Thorpe, 1944). Further, single items are more likely to be influenced by response sets or styles (Couch & Keniston, 1960; Crowne & Marlowe, 1960 Cahlstrom, 1962; Jackson & Messick, 1962). The forced choice method also has the advantage of requiring the testee to choose between two interests or activities, even when he is interested in neither or both (Anastasi, 1960).

Procedure

A procedure in common use for evaluating interests was used (Kuder, 1963). Originally, 484 questions dealing with personal preferences and general interest categories were generated. From a sample of 365 individuals, correlations were obtained between each questions and 10 liked and 10 disliked avocational interests. Totally, there were 154 avocational interest correlated with the 484 test questions. Any test question whose mean correlation with all interests was less than .20 was arbitrarily discarded. This resulted in the elimination of all but 70 questions. Based on their estimated frequency in the population (G.A.P., 1958), the 141 most popular avocations were retained. The 70 questions combined into 200 pairs of questions were correlated with expressions of interest for a given avocation, and printed out the six avocations whose total summed correlations with the answers were highest.

Instrument and Procedure

Six avocational interests are provided for each individual. It would be misleading to attempt to identify a single avocation for an individual as the result of reactions to two hundred test items, since a given individual's interests are typically multivariate and complex. There are other reasons for avoiding the selection of only one avocation for each person. Interests are associated primarily with given types of activities, and not with avocations as such; and so several of these activities may be associated with a number of different avocations. Further, there are certain limitations rather arbitrarily imposed by geographic

and economic variables. A man living in Florida, for example, might find snow skiing a highly rewarding avocation, but obvious problems might arise in finding an appropriate available location for this activity. By providing other related activities, such as perhaps water skiing, it is likely that he can find a satisfying avocation compatible with his major interest patterns.

RESULTS I
(Reliability and Validity)

Test-retest reliabilities over a 2-14 day interval ranged from .68 to .80 (both $p < .01$). Predictably, the higher reliability coefficients tended to occur at the shorter time intervals, and among the better educated Ss (eg. at 2 days, vocational counselors' $r = .80$). In terms of item validity, the preselection of only items with a mean average correlation $\geq .20$ with all avocational interests helped insure adequate validity as an integral part of the final form of the test (the value of .20 was chosen since an r of .195 is significant at the .05 level, with df 100). To demonstrate a measure of empirically determined predictive validity, once six avocations had been matched with interests for the sample of 365 Ss, the Ss were individually asked which of the six avocations they were certain they would enjoy. The number of avocations (out of the six chosen for them) which Ss indicated they would certainly enjoy ranged from 3.75 to 4.43).

RESULTS II
(Applications)

Since the original development and standardization of the test, two major applications have been investigated. One application involves its use as an aid in elevating employee morals by helping them make their leisure hours more productive, and the other deals with its use as a treatment adjunct for coping with problems of chronic alcoholism.

The first assessment of the procedure as an aid to improving employee morale involved providing the computer avocational matching program to all employees in one of six branch offices of a press clipping service. The dependent variable was defined as turnover rate. In the first seven months of use of this approach to helping make employees' leisure hours more satisfying, turnover was down 27% from the rate of the comparable seven month period of the preceeding year. (Hartlage, 1968). Subsequently, the program was used in a large bank, with turnover again used as the dependent to be 50% lower than in the comparable previous year's period. Although no formal followup figures are available, reports suggest that the low turnover rate is apparently remaining stable among those employees matched with appropriate leisure activities.

In terms of using leisure activity matching to help cope with alcoholism, one particular project helps illustrate some of the possibilities for its use in this sort of setting. Alcoholics who were admitted to an inpatient treatment facility were provided, in alternate months, with the avocational matching as part of their treatment, while patients admitted on the other alternate months received instead a series of talks about the importance of keeping busy, finding things to do, etc. The inpatient program lasted for three months, and at three and six months' intervals following

discharge relapse rates for patients in months who had been matched with avocational activities were compared with those who had been matched with avocational activities were compared with those of patient admitted in months who had received more traditional counseli Relapse rates at three month intervals were 18% vs. 6% for the vocational matched group, and at six months were 32% vs. 12% fo che avocational matched group. It was of considerable interest to rate that none of the avocationally matched Ss who relapsed had actually taken up the leisure time activity which the computer selected for him, whereas all but one of the successful (nondrinking) Ss had become actively involved in one of the activities selected for him.

DISCUSSION

Ther are, as Lee and Thorpe (1944) have pointed out, no purely o' ective criteria for establishing the validity of an occupational interests inventory. By the same token, attempts to establish objective criteria for the validity of an avocational interests inventory are equally meaningless, and carry the added danger of implying a degree of precision which is not reasonably inferred from the data. A number of factors may be incorporated into the design of the instrument which can add to the validity of such inventories, such as the selection of items, the design or description of items, and the presentation of items (Lee and Thorpe, ibid.).

Item Selection: Items were selected with regard to empirically established correlations between each item and the total list of 141 avocations, based on a sample of 362 subjects.

The final group of avocational interests was selected on the basis of: a) their selection by the original group of 362 subjects; b) their estimated frequency in A Preliminary Bibliography on Leisure (Denny & Meyersohn, 1957); and c) the estimated ranking of popularity as listed by the Group for the Advancement of Psychiatry (Report No. 39, 1958). Predominately on the basis of the general concurrence of the avocational interests listed by the 362 subjects with the popularity rankings of leisure time activities by the Group for the Advancement of Psychiatry, this basic group of avocations was considered to be adequately representative, on an operational basis, of American leisure time activities.

Design or Description of Items: This inventory avoids reactions to specific avocations as such, by avoiding mention of names of or references to specific avocational interests. This helps avoid possible "halo" effects or social desiribility effects. Further, this procedure helps prevent contamination of criterion measures by misleading-sounding avocations, whose name bears but scant resemblance to the activities it involves. By eliciting responses based on interest and activity preferences rather than specifically named avocations, it is possible to make relatively undistorted matchings of activities with avocations which the reverse procedure would tend to obviate. In addition, avoidance of specifically named avocations from among which the respondent must choose contributes materially to the face validity of the tests (Anastasi, 1960).

Presentation of Items: As has been mentioned, the forced choice technique was used. When two groups of activities are presented in contrast, the situation becomes more meaningful and concrete to the testee, and thus contributes to a more accurate choice. Research appears to confirm the superior stability of choices made in this manner (Lee & Thorpe, 1944, p.6).

Further, there is a built in item validity inherent in the system of item selection. Since items were retained only if their individual mean (positive or negative) correlations with given avocations were .20, item validity was enhanced.

It is not justifiable, of course, to conclude that providing workers with leisure time activities matched to meet their interests causes them to become better workers, just as it is not justifiable to conclude that the constructive use of hobbies can cure alcoholism. The findings with the use of a computer approach for matching interest patterns with appropriate leisure activities do suggest, however, that such an approach is feasible, and offer encouragement that future work using these sorts of approaches may be of value in helping cope with problems related to job alienation, drug abuse, or other sorts of problems; whereby the provision of satisfying leisure activities may help provide an individual with a satisfying outlet for his talents and energies.

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